

CHOCF

2.7.1

RE: Submittal of Harbor Oil risk assessment response to comments and revised Attachment 1

Suzanne Replinger

to:

Christopher Cora

07/28/2010 11:31 AM

Cc:

Arya Behbehani, "jdresser@bridgeh2o.com", "Rob B. Ede", Kathy Godtfredsen

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History: This message has been replied to and forwarded.

Chris –

Attached are 3 items for your review. The first is the draft response to EPA comments on the RI, which as for the response to comment table for the risk assessments, indicates the way that the Voluntary Group is planning to address the various comments. The other two items are the draft DDT text (Section 4.6 of the RI) and draft RAO text (Section 7.3 of the RI). Revisions to these two sections are shown in redline to indicate changes that have been made since the draft RI was submitted in April. Note that some risk estimates in the RAO table are highlighted in yellow, indicating that they have not been updated based on our agreed approach for the combined adult and child scenario. The table will be revised to show the cumulative lifetime risks for 0 to 30 years of age.

As with the documents relating to the risk assessments, we are trying to get a revised draft of the RI to the Voluntary Group by August 13, and if possible would thus appreciate any feedback on these submittals by Friday, August 6<sup>th</sup>.

Let us know if you have any questions.

Thanks

Suzanne

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**From:** Kathy Godtfredsen

**Sent:** Friday, July 23, 2010 4:15 PM

**To:** Cora.Christopher@epamail.epa.gov

**Cc:** Arya Behbehani; jdresser@bridgeh2o.com; 'Rob B. Ede'; Suzanne Replinger

**Subject:** Submittal of Harbor Oil risk assessment response to comments and revised Attachment 1

Chris – Attached is a response to EPA comments on the Harbor Oil risk assessments. These responses provide a roadmap for revisions being made to the risk assessments, and document some of our July 8, 2010 conference call discussions. Also attached is a revised version of Attachment 1 to the human health risk assessment, which

presents the results of the revised Hypothetical Future Resident Screening Assessment. This assessment was revised (in redline) in accordance with the approach discussed during the July 8, 2010 conference call. The tables were also revised, although changes are not shown in redline.

Please let us know if you have any questions on the revisions or the proposed approaches described in the response to comments. We'd like to provide the Voluntary Group with a revised version of the risk assessments by August 13 to meet the September 1 submittal date to EPA, so any feedback you can provide prior to that time would be appreciated. It would be ideal if we could get concurrence on approaches (especially the integrated lifetime exposure and the TPH assessment) by next Friday, July 30.

Next week, we plan to submit the response to comments for the remedial investigation as well as revised drafts of the DDT text (Section 4.6) and the RAO text (Section 7.3). Feedback in early August on these elements would also be greatly appreciated.

Please let us know if you have any questions or items you'd like to discuss. Thanks and have a great weekend!

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## 7.3 Evaluation of Preliminary RAOs

The Harbor Oil SOW identified preliminary RAOs for the Harbor Oil Study Area. These preliminary RAOs were provided in Appendix D, Remedial Action Objectives Technical Memorandum, of the RI/FS Work Plan (Bridgewater et al. 2008).

EPA guidance states that RAOs are media-specific goals for protecting human health and the environment (EPA 1988). The SOW included the following general preliminary RAOs for the Study Area:

- Control or eliminate ongoing sources of contamination, or other Study Area COCs, to groundwater, surface water, and sediment.
- Reduce or eliminate human and ecological exposure to any Study Area-related contaminated media that may lead to potential current or future unacceptable risk.

Table 7-9 summarizes the findings and risk estimates from the RI, HHRA, and ERA, along with the preliminary media-specific RAOs that were provided in the RAOs Technical Memorandum (Bridgewater et al. 2008). Based on work completed in the HHRA, one additional preliminary RAO was added under wetland soil in Table 7-9: control exposure to constituents in wetland soil that may result in unacceptable risk to human health. Based on the site-specific environmental information gathered during the RI and the findings of the HHRA and ERA, the preliminary RAOs appear to be inclusive and relevant for the assessment and management of current and future risks posed by the Harbor Oil Study Area.

**Deleted:** Facility-related chemicals

**Deleted:** These RAOs will be evaluated as part of the feasibility study process.

Table 7-9. Preliminary Remedial Action Objectives and Associated Remedial Investigation Findings

Preliminary RAO <sup>a</sup>	RI, HHRA, and ERA Findings	Summary	Deleted: Summary of
<b>Facility Soil</b>			
Reduce worker exposure to constituents in soil that may result in unacceptable risk.	In the HHRA, risks were within EPA's target risk range of $10^{-4}$ to $10^{-6}$ for current worker exposure ( $3 \times 10^{-6}$ for the industrial [construction/trenching] worker). Risks were less than $10^{-6}$ for the industrial/commercial worker vapor intrusion scenario. Risks for future outdoor worker exposure were also within EPA's target risk range of $10^{-4}$ to $10^{-6}$ ( $2 \times 10^{-5}$ ) but would be somewhat higher than the current outdoor worker scenario. The future risk estimate assumes that workers would be directly exposed to soils (i.e., without the existing gravel layer covering the Facility). All worker scenarios had HQs less than 1.	Risks for current and future workers were less than the upper end of EPA's target risk range ( $10^{-4}$ ) and an HQ of 1.	<div>Deleted: acceptable</div> <div>Deleted: Facility-related chemicals</div> <div>Deleted: acceptable</div>
Control migration of constituents from the soil berm that may result in unacceptable risks to ecological receptors or humans.	The soil berm is intact, vegetated, and has no identified areas of soil erosion. Concentrations were not necessarily higher or lower in the soil berm as compared with the surrounding wetland or Facility soil, indicating that the soil berm is not a source. Additionally, no clear concentration gradient was observed (i.e., concentrations in wetland soil did not consistently decrease with distance from the soil berm).	The findings of the RI do not indicate that the soil berm is a source of constituents to wetland soil or Facility soil.	<div>Deleted: Facility-related chemicals</div>
<b>Groundwater</b>			
Reduce worker exposure to constituents from the Study Area in shallow saturated zone groundwater that may result in unacceptable risk.	In the HHRA, excess cancer risks were less than $10^{-6}$ , and HQs were less than 1 for current worker exposure to groundwater ( $4 \times 10^{-7}$ for the industrial [construction/trenching] worker). Risks were also below these thresholds for the industrial/commercial worker vapor intrusion scenario.  Detected concentrations in groundwater were greater than the MCL or non-zero MCLG in shallow groundwater for arsenic, lead, benzene, and chlorobenzene, and in deep groundwater for trichloroethene. Arsenic was detected at concentrations up to 3 times greater than the MCL in about 45% of samples (both dissolved and total water samples). The other four constituents were detected at concentrations greater than the MCL in only 1 sample. It should be noted that MCLs and non-zero MCLGs are intended to be protective of the consumption of groundwater for drinking water. The groundwater at the Study Area is not currently used for drinking water, and this is not expected to change in the future based on land use designations.	Risks based on exposure to groundwater were less than $10^{-6}$ and an HQ of 1.  While detected concentrations were greater than the MCL or non-zero MCLG for five constituents, groundwater at the Study Area is not currently used for drinking water, and this is not expected to change in the future based on land use designations.	<div>Formatted: Font: Arial, 9 pt, Superscript</div> <div>Formatted: Font: Arial, 9 pt, Not Superscript/ Subscript</div> <div>Formatted: Font: Arial, 9 pt, Not Superscript/ Subscript</div> <div>Deleted: Facility-related chemicals</div> <div>Formatted: Font: Arial, 9 pt</div> <div>Formatted: Font: Arial, 9 pt, Not Highlight</div>



Table 7-9. Preliminary Remedial Action Objectives and Associated Remedial Investigation Findings (cont.)

Control migration of constituents in shallow saturated zone groundwater that may result in unacceptable risks to ecological receptors or humans.	<p>In the HHRA, risks from all constituents detected in groundwater were less than <math>10^{-6}</math> and had HQs &lt; 1.</p> <p>In the ERA, an analysis was done regarding risks to ecological receptors if shallow groundwater migrated to Force Lake. This evaluation concluded that groundwater discharging into the lake likely does not represent a significant pathway of exposure.</p> <p>The presence of LNAPL is localized and constrained to a small portion of the Facility in the vicinity of well GA-30. A 0.1-ft thick layer of LNAPL has been observed in well GA-30, and trace thicknesses (0.01 ft or less) have been observed in two of the extraction wells. No LNAPL has been observed in wells located along the downgradient boundary of the Facility. In 2009 (a year after sample collection), insufficient volume of LNAPL was available for collection at well GA-30.</p>	<p>Risks to humans from shallow groundwater were less than <math>10^{-6}</math> or an HQ of 1. Risks to ecological receptors are not expected to be greater than a HQ of 1 based on the uncertainty analysis performed in the ERA.</p> <p>Migration of constituents from shallow groundwater does not appear to be a concern, based both on shallow groundwater and LNAPL concentrations/extent.</p>	<p><b>Formatted:</b> Font: Arial, 9 pt, Superscript</p> <p><b>Deleted:</b> Facility-related chemicals</p> <p><b>Deleted:</b> Chlorinated solvents were detected in groundwater in deep well PW-01 and shallow well GA-34. Both wells are located in the east corner of the Facility near the Facility entrance and office buildings, suggesting that these VOCs are migrating onto the Facility from upgradient sources. ¶ DDD was detected in shallow groundwater samples collect from locations where DDD concentrations in soil samples were highest. DDD was detected in one intermediate and one deep groundwater sampling location from the south-central portion of the Facility. Given the low m ... [1]</p> <p><b>Deleted:</b> 4</p> <p><b>Deleted:</b> 4</p> <p><b>Deleted:</b> 4</p> <p><b>Deleted:</b> Facility-related chemicals</p> <p><b>Formatted:</b> Font: Arial, 9 pt</p> <p><b>Formatted:</b> Font: Arial, 9 pt</p> <p><b>Formatted:</b> Font: Arial, 9 pt</p> <p><b>Formatted:</b> ... [2]</p> <p><b>Deleted:</b> or intermediate</p> <p><b>Deleted:</b> s</p> <p><b>Deleted:</b> are</p> <p><b>Deleted:</b> T</p> <p><b>Formatted:</b> ... [3]</p> <p><b>Deleted:</b> Facility-related constituents</p> <p><b>Deleted:</b> Facility-related chemicals</p> <p><b>Formatted:</b> Highlight</p>
Control migration of constituents from shallow saturated zone groundwater to the deep saturated zone that may result in unacceptable risk to humans using deep groundwater as a potential future drinking water supply.	<p>With the exception of DDD at one location, constituents potentially attributable to historic releases within the Study Area detected in the deep groundwater zone at the Facility were not detected in the shallow or intermediate groundwater zones. Detected DDD concentrations in deep groundwater were below risk-based screening levels established for drinking water, and, as described below, appears to be attributable to a well construction issue. Therefore, the shallow groundwater zone is not a suspected source to the deep groundwater zone.</p> <p>DDD, a hydrophobic, nearly insoluble, and immobile constituent, was detected in the shallow, intermediate, and deep groundwater zones at the MW-2s/MW-2i/B-4 well cluster but at concentrations below the human health RSL. Given the low mobility of DDD, the presence of DDD is likely attributable to well construction methods or the integrity of deep well B-4 and is not a function of vertical migration. Well B-4 was developed pre-1990 and may have served as a conduit for the deeper migration of DDDs from surrounding soils. The mobility of DDD is low, and thus DDD is not expected to migrate off the Facility in groundwater to Force Lake.</p> <p>Based on the paucity of constituents detected in the intermediate groundwater zone, combined with the presence of intervening lower-permeability silt deposits that separate the three groundwater zones, constituents present beneath portions of the Facility in shallow groundwater do not appear to have significant migration potential to the deep groundwater zone.</p>	<p>Based on the findings of the RI, the vertical migration of constituents within groundwater from shallow saturated zone groundwater to the deep saturated zone does not appear to be a concern.</p> <p>It is suggested that well B-4 be decommissioned by the property owner based on the well's structural integrity.</p>	

Table 7-9. Preliminary Remedial Action Objectives and Associated Remedial Investigation Findings (cont.)

## Wetland Soil

<p>Reduce ecological receptor exposure to constituents in wetland soil that may result in unacceptable risk.</p>	<p><b>Wildlife:</b> In the ERA, effects-based HQs were less than 1.0 for many chemicals and receptors, but were estimated to be between 1 and 13, for red-tailed hawk (1.2 for total DDTs), Eastern cottontail (1.2 for mercury), and shrew (13 for mercury, 8.2 for total PCBs, and 8.5 for total DDTs). HQs were also greater than 1 for vanadium, aluminum, and selenium, but background concentrations of these metals were greater than Study Area concentrations.</p> <p>HQs were equal to 1.2 for hawk and cottontail, and thus were essentially equal to 1. HQ magnitudes for shrew were higher, but are uncertain, particularly from a population-level perspective. Although the Study Area contains habitat that is suitable for shrew, shrew have not been observed in any part of the Study Area. Other mammalian receptors that have been observed all have much lower ingestion rates, and thus would have lower exposure and risk estimates. In addition, the background LOAEL-based HQ for mercury ranged from 5.7 to 15 (compared with a Study Area HQ of 13), indicating that background likely contributes a significant portion of the Study Area concentrations of mercury. For PCBs, risks were based on a TRV for mink, which is extremely sensitive to PCBs, and thus risk estimates for other mammals, including shrew, are highly conservative.</p> <p><b>Invertebrates:</b> Wetland soil concentrations were greater than invertebrate SLs (e.g., for earthworms) for chromium (up to 370 times the SL or up to 3.5 times background), copper (up to 25 times the SL), mercury (up to 4 times the SL), zinc (up to 6.2 times the SL), and HPAHs (up to 3.2 times the SL). The highest chromium and copper concentrations were detected in the drainage ditch located to the west of the Facility.</p> <p>While soil concentrations were greater than thresholds for these constituents, the earthworm population observed during field sampling was healthy throughout the wetlands (including in areas where metals concentrations were highest).</p>	<p>Risk estimates for most of the COPC/receptor pairs were less than or equal to 1 or were less than background risk estimates. Risk estimates for shrew were higher, but are uncertain because shrew, which has a higher ingestion rate than other mammals observed in the area, have not been observed at the Study Area.</p> <p>While HQs calculated using general screening levels developed for the protection of earthworms were greater than 1 for five constituents, earthworm population level effects were not observed at the Study Area (i.e., earthworms were abundant).</p>	<p><b>Deleted:</b> 0</p> <p><b>Deleted:</b> (and for metals, had Study Area concentrations greater than background)</p> <p><b>Deleted:</b> Facility-related chemicals</p> <p><b>Deleted:</b> Discrete areas in the wetland with the highest PCB and DDT concentrations were identified southwest of the Facility between the Facility and Force Lake in the area where ponds/sumps that received drainage from the truck wash were reportedly located at the Facility (which likely extended into what is now considered the wetland)</p> <p><b>Deleted:</b> acceptable</p> <p><b>Deleted:</b> Facility-related chemicals</p> <p><b>Formatted:</b> Font: Arial, 9 pt, Highlight</p> <p><b>Formatted:</b> Font: Arial, 9 pt, Highlight</p> <p><b>Formatted:</b> Font: Arial, 9 pt, Highlight</p> <p><b>Formatted:</b> Font: Arial, 9 pt, Highlight</p> <p><b>Formatted:</b> Font: Arial, 9 pt, Superscript</p> <p><b>Formatted Table</b></p> <p><b>Deleted:</b> Facility-related chemicals</p> <p><b>Deleted:</b> Migration of constituents from wetland soils, where risks are within EPA's acceptable risk range of <math>10^{-4}</math> to <math>10^{-6}</math>, is expected to be minimal based on existing vegetative cover. The erosion of wetland soil into Force Lake does not appear to be resulting in additional exposure in Force Lake, as discussed in the uncertainty... [4]</p>
<p>Control exposure to constituents in wetland soil that may result in unacceptable risk to human health.</p>	<p>In the HHRA, risks were within EPA's target risk range of <math>10^{-4}</math> to <math>10^{-6}</math> for current adult and child Force Lake recreational users exposed to wetland soil (<math>2 \times 10^{-6}</math>), and HQs were less than 1.</p>	<p>Risks for recreational users based on exposure to wetland soil were less than the upper end of EPA's target risk range (<math>10^{-4}</math>) and an HQ of 1.</p>	
<p>Control migration of constituents in wetland soil that may result in unacceptable risk to ecological receptors or humans.</p>	<p>No lateral concentration gradients were apparent in Force Lake sediment (i.e., concentrations were not higher in the northern part of the lake or in the sediment area located near the discharge point of the ditch). Because concentrations of some of the constituents were significantly higher in some wetland areas than in lake sediment, limited or no contaminated soil migration appears to have occurred from the highly vegetated wetlands to the lake.</p>	<p>The findings of the RI do not indicate that significant migration of constituents is occurring.</p>	
<p><b>Lake Sediment</b></p> <p>Reduce recreational user</p>	<p>In the HHRA, risks were less than or equal to <math>10^{-6}</math> for current adult and child recreational</p>	<p>Risks for recreational users and</p>	

**Table 7-9. Preliminary Remedial Action Objectives and Associated Remedial Investigation Findings (cont.)**

exposure to <u>constituents</u> in lake sediment that may result in unacceptable risk.	users exposed to Force Lake sediment ( $6 \times 10^{-7}$ and $1 \times 10^{-6}$ , respectively). HQs were less than 1. Risks were within EPA's target risk range of $10^{-4}$ to $10^{-6}$ for current exposure via fish consumption ( $3 \times 10^{-5}$ for adults and $7 \times 10^{-6}$ for children). <u>HIs were equal to 2 for several endpoints.</u> A portion of this total risk estimate is attributable to background or reference area concentrations. The risk estimate for arsenic based on the regional background concentration was greater than the Study Area risk estimate for both adults and children. For both PCBs and DDTs, the Study Area risk estimate was higher than the reference area risk estimate, indicating that Study Area concentrations of DDTs and PCBs do not appear to be significantly influenced by regional concentrations.	fish consumers based on direct or indirect exposure to lake sediment were less than the upper end of EPA's target risk range ( $10^{-4}$ ). HQs were less than 1 for the Force Lake recreational user. The HQ was greater than 1 for the fish consumer scenario; HIs were equal to 2 for several endpoints.	<del>Deleted:</del> Facility-related chemicals <del>Deleted:</del> acceptable <del>Deleted:</del> , and HQs were less than or equal to 1 <del>Formatted:</del> Font: Arial, 9 pt <del>Formatted:</del> Font: Arial, 9 pt <del>Deleted:</del> background <del>Formatted:</del> Font: Arial, 9 pt <del>Deleted:</del> background <del>Deleted:</del> be between <del>Deleted:</del> and 10 <del>Deleted:</del> Facility-related chemicals <del>Deleted:</del> The cadmium effects-based HQ was greater than 10 for pumpkinseed (HQ of 15) as compared with a background HQ of 3.9 to 7.8 based on the range of DEQ background sediment concentrations. <del>Deleted:</del> Facility-related chemicals
Reduce ecological receptor exposure to <u>constituents</u> in lake sediment that may result in unacceptable risk.	In the ERA, effects-based HQs were estimated to <u>greater than 1</u> (and for metals, Study Area concentrations greater than background concentrations) for pumpkinseed (1.8 for copper, 15 for cadmium) and brown bullhead (1.1 for copper, 8.9 for cadmium). The background HQ for cadmium was between 3.9 and 7.8 for pumpkinseed and between 2.3 and 4.6 for brown bullhead based on the range of DEQ background sediment concentrations. It should be noted that there were two orders of magnitude of variability in the toxicological data reviewed for dietary exposure of fish to cadmium, and thus this TRV is uncertain. <u>HQs using the next lowest TRV would have resulted in HQs less than 1 for both pumpkinseed and bullhead.</u>	HQs were less than 2 for fish based on exposure to copper. The higher cadmium HQs (8.9 and 15) for fish were influenced by background concentrations and an uncertain TRV.	
If contaminated, control migration of <u>constituents</u> in lake sediment to connected water bodies and exposures that may result in unacceptable risk to ecological receptors or humans.	With the exception of metals, concentrations in North Lake sediment were generally less than those in Force Lake sediment. Concentrations of metals were generally similar to those in Force Lake and to background concentrations. These results indicate that the migration of constituents from Force Lake has been minimal and has not resulted in the presence of higher concentrations in North Lake.	The findings of the RI do not indicate that significant migration of constituents is occurring from Force Lake to North Lake.	
<b>Lake Surface Water</b>			
Reduce recreational user exposure to <u>constituents</u> in lake surface water that may result in unacceptable risk.	In the HHRA, risks were less than $10^{-6}$ for current adult and child recreational users exposed to Force Lake surface water ( $1 \times 10^{-7}$ and $6 \times 10^{-8}$ , respectively). HQs were less than 1.	Risks for recreational users based on exposure to lake surface water were less than EPA's target risk range ( $10^{-6}$ to $10^{-4}$ ) and an HQ of 1.	<del>Deleted:</del> Facility-related chemicals <del>Formatted:</del> Font: Arial, 9 pt, Highlight
Reduce ecological receptor exposure to <u>constituents</u> in lake surface water that may result in unacceptable risk.	Copper was detected at a concentration 3.1 times greater than the chronic AWQC and a factor of 2.5 times greater than the acute AWQC in one of three samples. However, the DEQ background water concentration was 6.9 times higher than chronic AWQC (i.e., was greater than the copper concentration detected in Force Lake). Barium was also detected at a concentration greater than the chronic water threshold; no background concentrations were available for barium. <u>However, Study Area sediment and soil concentrations of barium were less than or similar to background concentrations, indicating that barium concentrations in water may also be related to background concentrations.</u>	<u>Concentrations of some constituents were greater than AWQC values, but at concentrations less than background. This indicates that risks to ecological receptors from surface water are likely attributable to background.</u>	<del>Formatted:</del> Font: Arial, 9 pt, Superscript <del>Formatted:</del> Font: Arial, 9 pt, Superscript <del>Formatted:</del> Font: Arial, 9 pt <del>Deleted:</del> Facility-related chemicals

**Table 7-9. Preliminary Remedial Action Objectives and Associated Remedial Investigation Findings (cont.)**

<sup>a</sup> Bridgewater et al. (2008; Appendix D)

AWQC – ambient water quality criteria	ERA – ecological risk assessment	<u>MCLG – maximum contaminant level goal</u>
<u>COC – chemical of concern</u>	HHRA – human health risk assessment	PCB – polychlorinated biphenyl
<u>COPC – chemical of potential concern</u>	HPAHs –high-molecular-weight polycyclic aromatic hydrocarbon	RAO – remedial action objective
DDD – dichlorodiphenyldichloroethane	HQ – hazard quotient	<u>RI – remedial investigation</u>
DDT – dichlorodiphenyltrichloroethane	<u>LOAEL – lowest-observed-adverse-effect level</u>	<u>SOW – statement of work</u>
DEQ – Oregon Department of Environmental Quality	LNAPL –light non-aqueous phase liquid	SL – screening level
EPA – US Environmental Protection Agency	<u>MCL – maximum contaminant level</u>	TRV – toxicity reference value

Based on the results of the RI and baseline risk assessments, EPA will make risk management decisions for the Study Area and will determine whether risks are unacceptable. As discussed in EPA's *Guidance for conducting remedial investigations and feasibility studies under CERCLA* (EPA 1988), if the baseline risk assessments determine that risks are acceptable for humans and ecological receptors, the conclusions of the risk assessments and RI may serve as the primary means of documenting this decision. EPA guidance (1991) states that action is generally not warranted when carcinogenic risks are less than  $10^{-4}$ , non-carcinogenic risks are less than a HQ of 1, and when MCLs and non-zero MCLGs are not exceeded. This guidance also indicates that the risk assessment should characterize uncertainties when determining whether risks pose a threat to human health or the environment (EPA 1991).

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The following text summarizes the results of the RI and baseline risk assessments relative to EPA guidance:

- Carcinogenic risks for current and future RME scenarios in the HHRA were less than  $10^{-4}$ , the upper level of EPA's target risk range, which is typically used by EPA for risk management decisions (EPA 1991).
- Non-cancer HQs in the HHRA were less than 1 for all RME scenarios, with the exception of the Force Lake fish consumer scenario, for which several endpoint-specific HQs were equal to 2, just greater than EPA's threshold.
- Risks to ecological receptors were generally less than a HQ of 1, with the exception of three COPCs for wildlife (mercury, total PCBs, and total DDTs), two COPCs for fish (cadmium and copper), and five COPCs for terrestrial invertebrates (chromium, copper, mercury, zinc, and total HPAHs). As discussed in Table 7-9, considerable uncertainty exists regarding the likelihood that these COPCs would result in unacceptable population-level risks. These uncertainties include the influence of background concentrations (metals), toxicity values (cadmium for fish and PCBs for shrew), and species presence at the Study Area (shrew).
- Detected concentrations in groundwater were greater than the MCL and non-zero MCLG for arsenic (for approximately 45% of samples), as well as for 1 sample each for lead, benzene, chlorobenzene, and trichloroethene. However, the groundwater at the Study Area is not currently used for drinking water, and this use is not expected in the future.

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A residential screening assessment was conducted as part of the HHRA, which indicated that excess cancer risks would be greater than the upper end of EPA's target risk range ( $10^{-4}$ ) and greater than a HQ of 1. The results of this assessment indicate that a change in land use designation should not occur. However, it should be noted that future residential land use is unlikely at the Study Area based on current and expected future land use (industrial at the Facility or open space in the wetlands). Additionally, as noted in EPA guidance (EPA 1991), the NCP states that "the assumption of future residential land use may not be justifiable if the probability that the site will support residential use in the future is small."

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EPA will carefully evaluate the information presented in this RI relative to the RAOs for the Study Area to determine what next steps, if any, are necessary.

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## References

- Bridgewater, GeoDesign, Windward. 2008. Remedial investigation/feasibility study: work plan for the Harbor Oil site. Prepared for the Voluntary Group for the Harbor Oil Site RI/FS. Bridgewater Group, Inc., Lake Oswego, OR; GeoDesign Inc., Portland, OR; Windward Environmental LLC, Seattle, WA.
- EPA. 1988. Guidance for conducting remedial investigations and feasibility studies under CERCLA. Interim final. EPA/540/G-89/004, OSWER Directive 9355.3. Office of Emergency and Remedial Response, US Environmental Protection Agency, Washington, DC.
- EPA. 1991. Role of the baseline risk assessment in Superfund remedy selection decisions. OSWER Directive 9355.0-30. April 21, 1991. Office of Solid Waste and Emergency Response, US Environmental Protection Agency, Washington, DC.

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**Author**

Chlorinated solvents were detected in groundwater in deep well PW-01 and shallow well GA-34. Both wells are located in the east corner of the Facility near the Facility entrance and office buildings, suggesting that these VOCs are migrating onto the Facility from upgradient sources.

DDD was detected in shallow groundwater samples collect from locations where DDD concentrations in soil samples were highest. DDD was detected in one intermediate and one deep groundwater sampling location from the south-central portion of the Facility. Given the low mobility of DDD, one possible explanation for the presence of DDD in intermediate and deep wells is that pre-1990 well B-4 may have served as a conduit for the deeper migration of DDDs from surrounding soils. The mobility of DDD is low, and thus DDD is not expected to migrate off the Facility in groundwater to Force Lake.

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Migration of constituents from wetland soils, where risks are within EPA's acceptable risk range of  $10^{-4}$  to  $10^{-6}$ , is expected to be minimal based on existing vegetative cover. The erosion of wetland soil into Force Lake does not appear to be resulting in additional exposure in Force Lake, as discussed in the uncertainty analysis of the ERA.

U.S. ENVIRONMENTAL PROTECTION AGENCY COMMENTS ON DRAFT REMEDIAL INVESTIGATION STUDY FOR THE HARBOR OIL SITE, APRIL 7, 2010  
VOLUNTARY GROUP DRAFT RESPONSES – JULY 28, 2010

EPA Comment	Voluntary Group Response
<b>General Comments</b>	
1. The conclusions and the remedial action objectives (RAOs) in the Executive Summary (ES.7) and in Section 7 are relatively dismissive of the findings from the residential exposure evaluation. The conclusion of the residential exposure evaluations, although in ES6.1 text, is not presented as a key finding and is omitted from the Executive Summary Conclusions. Please include the potential risk posed by the site if residential exposure was assumed. If this requires the development of a quantitative Risk Assessment for residential exposure, that should be done using standard residential exposure scenarios provided for in EPA guidance. EPA acknowledges that the future anticipated land-use is not residential, but the information is required to assure the Site record provides adequate information to inform potential future development in inappropriate changes of land use at the Site.	Discussion of the results of the residential screening analysis has been added to Section ES.7 and to Section 7. This comment is related to HHRA specific comment 28 and RI specific comment 3.  This comment was discussed during the June 24 call with EPA. EPA is not requesting a formal residential scenario, but instead wants the RI to provide sufficient information in the RI in case there is a request for a change in land use in the future. Revisions will be made to the current screening assessment to compare RSLs with maximum detected concentrations; EPCs already calculated as part of the HHRA may also be compared to RSLs. The screening assessment will still be presented as an appendix to the HHRA.
2. The report makes mixed and inconsistent use of Study Area and Site. Revisions should be made to clarify and use Study Area as appropriate. There does not appear to be a clear or functional use of "Site." Sample locations figures should be revised to define the Study Area boundary. It is not clear how North Lake is related to the Study Area and it should be addressed either by the boundary or in a narrative explanation. For example, Figure 1-2 indicates that North Lake is outside of the Study Area boundary; however, sediment samples were collected from North Lake and thus it is part of the Study Area.	Terminology RI has been clarified by stating that the Site (as defined in the AOC) includes the Facility, wetlands & Force Lake. The term "Study Area" will be used to describe the entire sampled area (which includes a portion of North Lake). Because the exact boundary of the Site has not been determined, the term "Study Area" will be used throughout the RI.
3. Throughout the report there is specific reference made to "Facility-related" chemicals and/or chemicals of concern (COCs). These statements are not supported by rationale or by an identified list of the constituents. Use of the phrase obscures the meaning of the information being conveyed and the term should be either removed, or defined in one or more sections. For one example of the potential confusion in the information reported, please see Section 7.3 where the RAO statement appears to refer appropriately to "Study-Area COCs" but the Table 7-9 discussing the RAOs uses "Facility-related" chemicals. The report should clarify if there are Study-Area COCs that are not Facility-related chemicals.	All references to "Facility-related chemicals" have been removed to improve clarity. Text now refers to "constituents," the term that is used throughout the RI.
4. The Conceptual Site Model fails to address the source of COPC's and COC's at the facility and within the study area adequately. Speculative assumptions are inappropriate for a Remedial Investigation and need to be substantiated with literature references or field verification. For example, the RI should definitively address whether use of DDT by the City of Portland or another entity, such as the Stockyards, occurred in the area through archival research, interviews, etc.	The discussion of the source of DDD/DDE/DDT at the Study Area (Section 4.6.1) has been expanded to include possible sources of, and routes for, DDT to enter the environment and expected residual concentrations based on document review and other information. This section also has been expanded to include more discussion regarding conclusions that can be drawn from the suspected historical DDT uses in the area in conjunction with known DDT concentrations and distribution in the Study Area.
5. The RI report ends without a discussion of data limitations and recommendations for future work and without a clear path forward for the remedial objectives in the FS phase. Table 7-9 and Section 7 presents a summary of information and technical facts but do not provide a focus on whether the Study Area or Facility require further action or evaluation. The recommendations should include, but not be limited to, whether or not certain RAOs are achieved based upon existing conditions that may be protective of the specific receptors and exposure scenarios; whether or not groundwater monitoring is needed to further support remedial decision; and whether or not the non-aqueous phase liquid (LNAPL) as petroleum on groundwater surface requires periodic measurements and or recovery.	Based on a discussion with EPA, additional discussion concerning whether RAOs have been met based on guidance and existing site conditions will be incorporated into the revised RI as requested by EPA. In addition, the RI will include a discussion of the path forward. The path forward and RAO text will be drafted in consultation with EPA prior to submittal of the draft final. EPA will be responsible for making the final risk management decision and path forward decisions.
6. Data from the Portland Harbor Remedial Investigation indicate stormwater sediment contains DDT. This information would be a useful reference to put the presence of DDT in the Study Area in context.	Information regarding DDT concentrations in Portland-area stormwater catch basins has been added to Section 4.6.1 to provide context for DDT concentrations at the Study Area.
7. The Fish Consumption discussion relies too much on anecdotal references when the discussion could rely on the results of the Fish Survey conducted in Force Lake. Anecdotal information is valuable, but actual survey results are more objective.	Discussion was reviewed and revised to focus more on the results of the fish survey in the HHRA (fish consumption rates are not discussed in the RI).
8. Several sections of the report conclude that the volatile organic compounds (VOCs) in groundwater near the east margins of the Facility are migrating onto the Facility from upgradient sources. The conclusion is not supported by data because the RI does not provide upgradient (off Facility) groundwater data, the detected chemicals are similar to those on the Facility, and the RI does not identify potential upgradient sources. The RI should substantiate "upgradient" sources which are alleged to contribute to groundwater contamination. The statement should be revised and supported with facts.	Additional presentation of data and discussion have been added to support the conclusion that the VOCs identified near the northeastern margins of the Facility (GA-34 in the shallow zone and PW-01 in the deep zone) do not originate on the Facility. This information is summarized below.  Well GA-34 is located at the up-gradient margin of the Facility with regard to the shallow groundwater zone and is not located down-gradient of suspected constituent source areas at the Facility. Low-level and limited (year 2000 only) detections of vinyl chloride and cis-1,2-DCE at this location, in conjunction with the up-gradient position on the property, do not suggest an on-site or continuing off-site source for these VOCs. Similarly, low level benzene detections at this location (less than 3 µg/L) in conjunction with the position of this well being on the upgradient margin of the property, is not suggestive of an on-site source to this location. For the reasons cited, additional evaluation with regard to these one-time or low level detections is not deemed necessary.  As documented in GAI (1990), TCE and/or PCE have historically been identified in deep zone groundwater samples (Pleistocene gravels, generally greater than 100 feet bgs) collected from the Harbor Oil supply well, the Portland Stockyard production well, and from several other deep borings or wells in the area.  Further investigations related to TCE and PCE presence in deep groundwater were documented in GAI (1991). These additional



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yEPA Comment	Voluntary Group Response
<b>General Comments</b>	
<p>1. The conclusions and the remedial action objectives (RAOs) in the Executive Summary (ES.7) and in Section 7 are relatively dismissive of the findings from the residential exposure evaluation. The conclusion of the residential exposure evaluations, although in ES6.1 text, is not presented as a key finding and is omitted from the Executive Summary Conclusions. Please include the potential risk posed by the site if residential exposure was assumed. If this requires the development of a quantitative Risk Assessment for residential exposure, that should be done using standard residential exposure scenarios provided for in EPA guidance. EPA acknowledges that the future anticipated land-use is not residential, but the information is required to assure the Site record provides adequate information to inform potential future development in inappropriate changes of land use at the Site.</p>	<p>Discussion of the results of the residential screening analysis has been added to Section ES.7 and to Section 7. This comment is related to HHRA specific comment 28 and RI specific comment 3.</p> <p>This comment was discussed during the June 24 call with EPA. EPA is not requesting a formal residential scenario, but instead wants the RI to provide sufficient information in the RI in case there is a request for a change in land use in the future. Revisions will be made to the current screening assessment to compare RSLs with maximum detected concentrations; EPCs already calculated as part of the HHRA may also be compared to RSLs. The screening assessment will still be presented as an appendix to the HHRA.</p>
<p>2. The report makes mixed and inconsistent use of Study Area and Site. Revisions should be made to clarify and use Study Area as appropriate. There does not appear to be a clear or functional use of "Site." Sample locations figures should be revised to define the Study Area boundary. It is not clear how North Lake is related to the Study Area and it should be addressed either by the boundary or in a narrative explanation. For example, Figure 1-2 indicates that North Lake is outside of the Study Area boundary; however, sediment samples were collected from North Lake and thus it is part of the Study Area.</p>	<p>Terminology RI has been clarified by stating that the Site (as defined in the AOC) includes the Facility, wetlands &amp; Force Lake. The term "Study Area" will be <del>used to describe</del> the entire sampled area (which includes a portion of North Lake). Because the exact boundary of the Site has not been determined, the term "Study Area" will be used throughout the RI.</p>
<p>3. Throughout the report there is specific reference made to "Facility-related" chemicals and/or chemicals of concern (COCs). These statements are not supported by rationale or by an identified list of the constituents. Use of the phrase obscures the meaning of the information being conveyed and the term should be either removed, or defined in one or more sections. For one example of the potential confusion in the information reported, please see Section 7.3 where the RAO statement appears to refer appropriately to "Study-Area COCs" but the Table 7-9 discussing the RAOs uses "Facility-related" chemicals. The report should clarify if there are Study-Area COCs that are not Facility-related chemicals.</p>	<p>All references to "Facility-related chemicals" have been removed to improve clarity. Text now refers to "constituents," the term that is used throughout the RI.</p>
<p>4. The Conceptual Site Model fails to address the source of COPC's and COC's at the facility and within the study area adequately. Speculative assumptions are inappropriate for a Remedial Investigation and need to be substantiated with literature references or field verification. For example, the RI should definitively address whether use of DDT by the City of Portland or another entity, such as the Stockyards, occurred in the area through archival research, interviews, etc.</p>	<p>The discussion of the source of DDD/DDE/DDT at the Study Area (Section 4.6.1) has been expanded to include possible sources of, and routes for, DDT to enter the environment and expected residual concentrations based on document review and other information. This section also has been expanded to include more discussion regarding conclusions that can be drawn from the suspected historical DDT uses in the area in conjunction with known DDT concentrations and distribution in the Study Area.</p>
<p>5. The RI report ends without a discussion of data limitations and recommendations for future work and without a clear path forward for the remedial objectives in the FS phase. Table 7-9 and Section 7 presents a summary of information and technical facts but do not provide a focus on whether the Study Area or Facility require further action or evaluation. The recommendations should include, but not be limited to, whether or not certain RAOs are achieved based upon existing conditions that may be protective of the specific receptors and exposure scenarios; whether or not groundwater monitoring is needed to further support remedial decision; and whether or not the non-aqueous phase liquid (LNAPL) as petroleum on groundwater surface requires periodic measurements and or recovery.</p>	<p>Based on a discussion with EPA, additional discussion concerning whether RAOs have been met based on guidance and existing site conditions will be incorporated into the revised RI as requested by EPA. In addition, the RI will include a discussion of the path forward. The path forward and RAO text will be drafted in consultation with EPA prior to submittal of the draft final. EPA will be responsible for making the final risk management decision and path forward decisions.</p>
<p>6. Data from the Portland Harbor Remedial Investigation indicate stormwater sediment contains DDT. This information would be a useful reference to put the presence of DDT in the Study Area in context.</p>	<p>Information regarding DDT concentrations in Portland-area stormwater catch basins has been added to Section 4.6.1 to provide context for DDT concentrations at the Study Area.</p>
<p>7. The Fish Consumption discussion relies too much on anecdotal references when the discussion could rely on the results of the Fish Survey conducted in Force Lake. Anecdotal information is valuable, but actual survey results are more objective.</p>	<p>Discussion was reviewed and revised to focus more on the results of the fish survey in the HHRA (fish consumption rates are not discussed in the RI).</p>
<p>8. Several sections of the report conclude that the volatile organic compounds (VOCs) in groundwater near the east margins of the Facility are migrating onto the Facility from upgradient sources. The conclusion is not supported by data because the RI does not provide upgradient (off Facility) groundwater data, the detected chemicals are similar to those on the Facility, and the RI does not identify potential upgradient sources. The RI should substantiate "upgradient" sources which are alleged to contribute to groundwater contamination. The statement should be revised and supported with facts.</p>	<p>Additional presentation of data and discussion have been added to support the conclusion that the VOCs identified near the northeastern margins of the Facility (GA-34 in the shallow zone and PW-01 in the deep zone) do not originate on the Facility. This information is summarized below.</p> <p>Well GA-34 is located at the up-gradient margin of the Facility with regard to the shallow groundwater zone and is not located down-gradient of suspected constituent source areas at the Facility. Low-level and limited (year 2000 only) detections of vinyl chloride and cis-1,2-DCE at this location, in conjunction with the up-gradient position on the property, do not suggest an on-site or continuing off-site source for these VOCs. Similarly, low level benzene detections at this location (less than 3 µg/L) in conjunction with the position of this well being on the upgradient margin of the property, is not suggestive of an on-site source to this location. For the reasons cited, additional evaluation with regard to these one-time or low level detections is not deemed necessary.</p> <p>As documented in GAI (1990), TCE and/or PCE have historically been identified in deep zone groundwater samples (Pleistocene gravels, generally greater than 100 feet bgs) collected from the Harbor Oil supply well, the Portland Stockyard production well, and from several other deep borings or wells in the area.</p> <p>Further investigations related to TCE and PCE presence in deep groundwater were documented in GAI (1991). These additional</p>

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	<p>investigations included a well survey with subsequent deep zone groundwater sample collection at supply wells W-5 (125 feet deep) and W-6 (86 feet deep) at the Heron Lakes Golf Course, and at a supply well of 166 feet depth located at the nearby Exposition Center property. Additionally, sampling results for the James River Corporation property well (No.2, 163 feet deep) were identified and reported.</p> <p>As summarized in GAI 1990 and GAI 1991, testing of groundwater samples collected from wells described above identified TCE and PCE concentrations within the deep groundwater zone that were relatively similar (generally between 1 and 20 µg/L). A table summarizing PCE and TCE results as available for area-wide deep zone wells, and a figure depicting the identified well locations are included within the revised RI report.</p> <p>As described in the RI report, no detectable concentrations of PCE or TCE have been identified within shallow or intermediate depth groundwater samples collected from the Harbor Oil Facility. Detections of PCE and TCE within shallow groundwater have been described at the Portland Stockyards property (GAI 1990).</p> <p>The area-wide nature of the PCE and TCE detections in deep groundwater in conjunction with the lack of such detections in the shallow or intermediate-depth groundwater zones at the Harbor Oil Facility provides sufficient documentation to conclude that the Harbor Oil Facility is not a contributing source of these constituents. The VG does not agree that it is the function of the RI or a responsibility of the VG to pinpoint the specific source for a deep area-wide chlorinated solvent plume when there is ample evidence to conclude that it is not sourced at the Harbor Oil Facility.</p>
9. The second page or continuing pages of the tables should have within the title "Continued" or "Page X of Y" to alert the reader to a multi-page table. See Section 4 for examples of multi-page tables needing title or page number revisions.	This formatting change has been made in the revised RI.
10. For simplicity, clarity and reduction of duplicative topics, the information for fate and transport (Sections 4.3.2, 4.4.2, 4.5.2, 4.6.2, 4.7.2, and 4.8.2) could be moved into Section 5.2.	The format of the draft RI (constituent-group specific vs. media specific) was selected in an effort to provide the best narrative for the reporting. Regardless of format selected, there would be some duplication of topics between sections. It is agreed that the consolidation of individual fate and transport subsections from Section 4 into a single subsection in Section 5 will add clarity and reduce redundancy. These changes have been incorporated into the revised document.
11. For simplicity, clarity and reducing some duplicative topics, the information and topics relating to exposures pathways and receptors in the first paragraph of Section 5.0 and Section 5.3 would best serve the report in Section 6. The diagram of Figure 6-1 covers the subject but narrative is needed in Section 6.	Additional narrative has been added to Section 6 using the information from Section 5.0 and 5.3.
12. Many figures don't include all sampling locations. For example: Figure 4-10 does not include SL-32, SL-45, or SL-46. But Figure 4-9 does include those locations. Please provide a note explaining why some locations are not depicted on a figure.	A complete QC of figures has been done to ensure that all samples locations are shown. If a location was not sampled for a given constituent, a footnote was added to that figure to clarify this.
<b>Specific Comments</b>	
1) Executive Summary and Section 1.1 – Identification of the objectives for the Remedial Investigation (RI) should be completed by stating that the objective is to support an informed risk management decision "regarding the remedy for the site." The RI provides information to support identification of remedial alternatives and for selecting a remedy (including a no further action alternative). This key component of the process is missing from the objective statement.	Text has been edited in the revised RI.
2) Executive Summary and Section 1.3 – Information should be provided regarding how the Site and Study Area were defined during the regulatory process. The description of the Study Area should provide the total size (acres) of which the 4.1-acre Facility is a subcomponent.	The use of the terms Site and Study Area have been clarified. Additionally, the size of the Study Area (19 acres) was added to the RI.
3) Executive Summary ES.2 – The bullet list of sample and/or location counts appears to be inconsistent with information presented in the RI (see Table 4-1). A presentation of either number of samples or number of locations is recommended. In addition, a count that is consistent with Table 4-1 should be considered. The 61 locations for Facility samples should indicate that the count includes stockpile and berm samples. The count of wetland soil samples could be interpreted as being 57 (47 plus 10), whereas Table 4-1 has 46 locations.	The discrepancies noted between the list in ES.2 and Table 4-1 have been corrected. To reduce future confusion, it has been clarified that these numbers represent a count of locations (not samples).
4) Executive Summary ES.3 – Brevity is good, but there could be slightly more information. For example, the "Meteorology" could include brief mention of mean precip and mean temperature. The "Hydrogeology" topic could include the basic depth to groundwater and less about the various vertical gradients and a discussion of groundwater discharge to Force Lake.	The balance between brevity and the amount of detail conveyed within an Executive Summary can prove challenging. EPA's desire for slightly more information, including the cited examples, is acceptable and the document has been revised accordingly.
5) Executive Summary ES.3 – Information presented in the last two bullets does not appear consistent for the Study Area. The predominant use of the Study Area appears to be recreation (surrounded by golf course) with public access, and managed as a wetland habit. The "Facility" is an industrial property, being only a portion of the Study Area. Land use, current and future for the Study Area, could be described as recreation, habitat, and wetlands, as well as industrial.	Text has been added to this section stating that the likely future land use of Force Lake and the wetlands is recreation and habitat for ecological receptors.

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<p>6) Executive Summary ES.4 Nature and Extent – The opening paragraph is too heavy on detail for Executive Summary and does not appear to follow with the remaining text. Suggested phrase is to state that specific analytes or analyte groups were selected for presentation based upon their association with past use of the Facility or for their contributions to human health risk and ecological effects. Key Findings should include mention of LNAPL and principle constituents which contribute risk.</p> <p>a) The summary Tables would be more informative of nature and extent if the frequency of detections and or number of detections per analyses were listed instead of the mean value. Because the RI concludes that the presence of LNAPL is isolated and very minor, the Executive Summary should mention its limited presence but not include analytical results in the table.</p> <p>b) The bullet list summary of key nature and extent points can be improved by reducing some detail and identifying analyte groups that matter most (total petroleum hydrocarbons [TPH], polycyclic aromatic hydrocarbons [PAH], polychlorinated biphenyls [PCB], pesticide), media (soil, sediment, surface water, groundwater) and with a consistent comparison to the criteria (RSL) or other screening values. The vicinity can be mentioned relative to the media. The third bullet is an example and could use mention of which analyte groups were detected.</p>	<p>Intro text: The opening paragraph of ES.4 has been removed per EPA comment.</p> <p>a. Detection frequencies (percentages) have been added to Tables ES-1 and ES-2 and presentation of LNAPL results has been removed from Table ES-2.</p> <p>b. Discussion of nature and extent was expanded to include more discussion of the analyte groups that matter most and to provide additional information regarding comparison to criteria.</p>
<p>7) Executive Summary ES.5 - The Conceptual Site Model (CSM) discussion should identify pathways and media for the Study Area. The summary bullets provided relate to the Facility and Facility soils with one mention of adjacent wetlands. Please include brief summary of migration potential to surface water, sediment, and groundwater. This section should include a brief discussion of future land use.</p>	<p>Section ES.5 has been revised as requested based on the changes to Section 5.</p>
<p>8) Executive Summary ES.6.1 Human Health Risk Assessment – The last part of the first paragraph could replace the “conservative” word and express the perspective that the scenarios used were selected to support the risk-based decision process by assuring that the risks are not underestimated.</p> <p>a) The Table ES-3 please clarify or revise the bolded phrase “Total risk across media” because this appears to present the cumulative risk per scenario.</p> <p>a) Present the hazard quotients as the actual value rather than &gt;1.</p> <p>b) The Table ES-4 may not be needed for an Executive Summary presentation. The most important executive summary type facts from Table ES-4 could be presented as a brief narrative immediately following Table ES-3. The summary could focus on the two exposure scenarios with risk in the 10<sup>-5</sup> range and the constituents that contribute greater than 30 percent to the risk. There does not appear to be a need to have a narrative summary for the child recreational scenario or the child fish consumption. However, that may remain. In addition, because the risks are within the risk management range, there is not a particular need, in the Executive Summary, to discuss the contribution from background or naturally occurring concentrations of arsenic.</p> <p>c) Please clarify the terminology “without identified sources” used in the last paragraph, and also in Sections 6.2.4, 7.1.6.1, and 7.1.6.2. The purpose of the RI is to identify the sources of COCs at a site.</p>	<p>a. Text changed to “cumulative risk across media.”</p> <p>a. Table ES-3 has been modified to show HIs when total HQs were greater than 1, as done in the HRHA.</p> <p>b. Table ES-4 has been deleted and a brief narrative has been added to discuss percent contribution to the total excess cancer risk and background/reference area risk estimates.</p> <p>c. This phrase was intended to clarify that the “reference area” concentrations for organic compounds were from locations not known to have specific sources areas (i.e., not industrial properties known to be polluted). However, the Voluntary Group agrees that this language could be confusing, and thus it was removed from the revise RI.</p>
<p>2) Executive Summary ES.7 This section can be reduced because many of the details should already be in previous ES sections, or are not required for executive summary level of information.</p>	<p>Section ES.7 has been shortened to remove some of the excess detail provided in earlier sections of the ES or detail that is not needed in an ES.</p>
<p>3) Executive Summary ES.7.1 – The risk conclusion for the results of screening for residential exposure should be presented in this section.</p>	<p>Details regarding the residential screening assessment have been added to the revised RI.</p>
<p>4) Executive Summary ES.7.2 The statements, “likely attributable to non-Facility-related sources” and “migrating onto the Facility from up-gradient sources” are not supported by the details of the RI and should not be part of the Executive Summary information.</p>	<p>As clarified in the response to general comment 8, the document has been revised to include additional details as needed to support these conclusions and as such these conclusions have not been removed from the document. Minor revisions to the related discussion in Section ES.7.2 have been included to provide clarity regarding the support for these conclusion statements.</p>
<p>5) Executive Summary ES 7.2 states that “it is suspected that well B-4 may have served as a conduit for the deeper migration of DDD from surrounding soils.” This hypothesis is repeated again in Sections 4.6.3.2, 5.2.1.1, 7.2.2, and Table 7-9. For example, Section 5.2.1.1 states that “one possible explanation for the presence of DDTs in intermediate and deep wells is that B-4 is an older well established prior to 1990 and may have served as a conduit for the deeper migration of DDTs from surrounding soils. However, the mobility of DDTs in soil is generally low.” EPA previously commented on this issue (Section 6.2.2 of the Draft Preliminary Site Characterization Report stated that the “presence of DDTs in the deep zone reflects a problem with the integrity of deep well B-4”). EPA’s comment was that “Adequate evidence is not presented to support this conclusion. Furthermore, if there is a problem with the integrity of well B-4, immediate action may be required to address the issue of potential cross contamination.” VG’s response was to confirm the results with isotope dilution methods during Phase 2. Now that the results have been confirmed, please address EPA’s previous comments. The RI inappropriately selects “one possible explanation”</p>	<p>The detailed response to EPA comments on this matter is provided as the response to specific comment 55 (related to Section 5.2.1.1). The EPA is correct that there is not adequate evidence to definitively conclude that the identified DDD concentrations in the intermediate and deep groundwater zones are the result of a well seal breach (note that the detections were below human health screening levels). However, neither is there adequate evidence to support a conclusion that the DDD has migrated to these depths via natural groundwater transport mechanisms. In fact, natural transport is deemed highly unlikely due to the extremely high retardation of DDD as described in response to Comment 55.</p> <p>The well seal breach hypothesis was developed based on a weight of evidence approach and vertical channeling through a breach in the well seal of B-4 is still felt to be the most likely mechanism leading to the presence of DDD at the adjacent MW-2i location and the B-4 location.</p>

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instead of verifying the explanation.	Based on the preceding information and as per a path forward suggested by the EPA – it is recommended that the owner of well B-4 decommission that well in accordance with the requirements of the State of Oregon. The proper decommissioning of this well will eliminate that borehole as a possible conduit for vertical migration.
6) LNAPL is identified in the wrong well, it should be GA-30.	Several sections of the Executive Summary erroneously identified well GA-34 as containing LNAPL. The EPA comment is correct in that well GA-30 should have instead been cited in order to be accurate and consistent with the body of the report. The report has been revised accordingly.
7) Executive Summary ES.7.4- Force Lake Sediment and Surface Water – The 7 <sup>th</sup> bullet discussion regarding the effects of total organic carbon (TOC) on the bioavailability of dichlorodiphenyltrichloroethane (DDT) is not clearly developed or quantified in the RI report and should not be presented in the Executive Summary. If the bioavailability is to be considered, the effect of TOC should be quantified and developed for both DDT and PCBs. Include a bioavailability discussion in the text.	A discussion of the effects of TOC on bioavailability has been added to Section 5.
8) Executive Summary ES.7.5 Remedial Action Objectives – Include the RAO's that were developed. The two bulleted RAOs listed in Section 7.3 should be presented and related to the current finding of the risk assessment. Conclusions can offer risk-based facts to identify if the current conditions are adequately protective and some RAOs met or what RAOs can be the focus of the next phase.	Text will be added. See response to general comment 5.
9) Figure 1-4 <i>Potential Off-Facility Sources</i> : Should include facilities and features discussed in text. Not all upgradient facilities (source of TCE in PW-01 for example) are included on the figure.	Figure 1-4 has been updated to expand the area shown such that the full extent of the properties described in the text are depicted. The locations for the deep area-wide sampling for chlorinated solvents that were conducted as part of the Portland Stockyard investigation are identified on Figure 3-4.
10) Figure 1-5 <i>Former Facility Features</i> . Needs to include utilities, former septic tanks, other underground piping, and location of the curtain drain piping. There should also be a figure depicting changes in Facility topography.	Available documents were reviewed and a representative of the current Facility operator (D. Coles) was contacted to identify all known subsurface utility locations at the Facility. The results of this additional research have been incorporated into Figure 1-5. Similarly, changes in Facility topography were researched and the findings have been added to the revised report.
11) Figure 1-6, and 1-7: Sampling locations EW-1, EW-2, and EW-3 are not shown on the figure, but are mentioned in text. Include them on the appropriate figure.	Wells EW-1 through EW-3 were not installed as groundwater monitoring wells and were therefore never sampled. Additionally, no soil samples were collected during the installation of these wells, and only trace levels of LNAPL have been identified (insufficient for sample collection) at any of these locations. Because Figures 1-6 and 1-7 depict surface water and soil sampling locations, the locations of EW-1 through EW-3 are not depicted on these Figures. Wells EW-1 through EW-3 are instead depicted on Figure 1-8 (pre-RI well locations) and 2-1 (pre- and post-RI well network). The text has been clarified so that references to appropriate figures are readily discernable.
12) 1.3.2 <i>Facility History</i> . There should be a discussion of activities associated with the installation of the extraction wells.	<p>Clarification regarding the history and purpose of extraction wells EW-1 through EW-3 have been included in the revised RI document. Extraction wells EW-1 through EW-3 were installed by Coles Environmental, Inc. in 2003 coincident with the construction of the base-oil plant at the Facility. Based on a personal communication with Mr. David Coles on June 16, 2010 (Rob Ede to David Coles), extraction wells EW-1 through EW-3 were installed solely as a precautionary measure within three pits that were backfilled with angular gravels and cobbles that had been dug below the water table as part of foundation and electrical work conducted for the base oil plant construction.</p> <p>Specifically, according to David Coles, these wells were installed within the existing pits out of recognition that pits filled with granular material within the oil plant area would make excellent LNAPL collection points and that it would be remiss not too plan ahead for the potential removal of any accumulated LNAPL. As such, there were never any specific plans to operate these wells.</p> <p>As documented in the RI, wells EW-1 through EW-3 have not identified the presence of recoverable volumes of LNAPL, and for that reason they have never been used for recovery. The function of wells EW-1 through EW-3 remains entirely precautionary in nature.</p>
13) 1.3.2 <i>Facility History</i> . Site history notes that Union Stockyard was a site owner and cattle truck washing was 90% of the washing business. Add a discussion about the use of DDT and other pesticides at the stockyards and evaluate this as a potential source for DDT present within the Study Area. Considering the drainage patterns in the earlier aerial photos, the distribution of DDT may be consistent with a source at the truck washing facility. DDT dusting/spraying of cattle and hogs should be evaluated and discussed in the RI.	<p>A review of available documents at the DEQ Northwestern Region Office was conducted on June 16, 2010 in an effort to determine what, if any, testing for DDT or other pesticides has been conducted on the former Portland Union Stockyard property. The effort included a review of all files made available by DEQ for ECSI Sites 1091 (Portland Union Stockyard property) and 1505 (Peninsula Terminal Property). The Peninsula Terminal property is immediately south of the former stockyard pens and was used for loading and unloading livestock.</p> <p>Although conventional wisdom of practices at the time would suggest that DDT may have been used for pest control and as a cattle or hog dip or spray at the Portland Stockyards property, no documentation confirming disproving DDT use was identified. Although speculative, it is reasonable to conclude that DDT may have been used at the Portland Union Stockyards property as</p>

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	<p>suggested by EPA. Similarly, if present in residues on cattle trucks, then DDT could have been distributed at the Harbor Oil property as a function of the trailer cleaning operation. Therefore, EPA is correct that the distribution of DDT concentrations in soil in vicinity of the former truck wash, in conjunction with the historical site topography/drainage, is suggestive that rinsate from the former truck wash may have entrained DDT residuals, as was described in the draft RI report.</p> <p>Additional discussion regarding the preceding issue has been included in the revised report. The VG Group would like to stress that although a specific source for the DDT may not be unequivocally presented in the RI, the nature and distribution of the DDT has been presented and sufficient evaluation and study have been completed to demonstrate the lack of an on-going release of DDT to Facility soils and to describe the nature and extent of DDT concentrations.</p>
<p>14) 1.3.2 <i>Facility History</i>. There should be some discussion if leak testing has been done on the pipes or tanks and the results of those tests. The presence of gasoline in soils may indicate relatively current releases are occurring.</p>	<p>According to David Coles, Coles Environmental Consulting, Inc., tightness testing of tanks and piping has not been completed by EMRI. The text within Section 1.3.1.2 has been updated as such. As depicted on Figures 4-4 and 4-10, in relation to known location of underground petroleum piping, the greatest gasoline-range hydrocarbon concentrations were identified in shallow soils proximate to this underground product line. The presence of these shallow impacts could be a function of a release associated with the piping in this area. This information will also be noted in the discussion concerning distribution of benzene/gasoline in soil found in Section 4.</p>
<p>15) 1.3.2.7.5 <i>New Base-Oil Refining Plant Construction</i>. Should include a discussion of impacted soil and field observations encountered during these excavation activities.</p>	<p>Discussion of field observations of impacted soils encountered during the 2003 Base-Oil Refining Plant construction activities has been incorporated into Section 1.3.2.7.5 of the revised RI Report. A summary of this additional information is provided below.</p> <p>Mr. David Coles of Coles Environmental, who oversaw the soil excavation and stockpiling of soils during construction of the base-oil plant construction, indicated during a June 16, 2010 telephone conversation with Mr. Rob Ede of Hahn and Associates, Inc. that there was no formal write-up of observations made during the 2003 base-oil plant construction-related excavation activities. Review of historical documents that describe or summarize historical activities at the Facility were completed and no information concerning field observations of impacts were identified, although analytical testing in the base oil plant area was conducted prior to construction as is described in Section 1.3.3.4 of the revised RI report.</p> <p>Mr. Coles provided a general description during the above-referenced telephone conversation of the types and magnitude of visually impacted soils as were made during the base-oil plant construction-related excavation work. Mr. Coles indicated that evidence of oil was apparent in soils as they were excavated, with zones of “clean” (e.g., minor or lack of visual indications of impact) soils mixed with zones or layers/lenses of soil that varied from dark staining and a petroleum odor to discontinuous zones (lenses or layers) of soils that had visual evidence of oil product. He cited that these oily layers or lenses might typically be on the order of one inch thick by several feet in length and were not continuous (e.g., patchy) over the area of excavation.</p>
<p>16) 1.3.3.4 2003 <i>CEC Soil Sampling</i>. Although the data did not meet DQOs, the analyzed constituents and their concentrations should be discussed.</p>	<p>As requested by EPA, the results of the 2003 CEC Soil Sampling activities have been discussed in a revision of Section 1.3.3.4.</p>
<p>17) Figure 1-9: Describe the effect and purpose of the Pump Station in the text. Is it to control Groundwater elevations? A sewage pump station? Can it effect groundwater flow within the Study Area? Etc..</p>	<p>There are two “pumping stations” noted on Figure 1-9, both of which pump surface water runoff from one side of a dike or levee to another side of a dike or levee. Based on what is known regarding the function of these pumping stations, neither pumping station is expected to influence the groundwater flow regime in the Study Area. At the EPA’s request, the text of the RI has been revised to identify and describe each of these pumping stations, referencing Figure 1-9. Included in the revised text is a description of potential influence to the groundwater flow regime within the Study Area (none are expected).</p>
<p>18) Section 2.0 – top of page 53. The bullet list presents the study objectives and not the RAOs. Please revise.</p> <p>a. The second item in bullet list at bottom of page 53 refers to “Facility-related chemicals.” The definition of this phrase is not provided. The text should be revised to define this phrase (e.g., specific chemicals) and distinguish this phrase from the phrase, chemicals of concern (COC).</p> <p>b. The last item in the bullet list at bottom of page 53 refers to evaluating chemicals of concern (COCs) in the risk process. However, the COCs are the outcome of the risk evaluation. Please revise. Perhaps this reference should be made to evaluating chemicals of potential concern.</p>	<p>These changes have been made in the revised RI. Also see response to general comment 2.</p>
<p>19) Section 2.3.1.3 <i>Water Level and Free Product Measurements</i>. Note that the water level was often above the screen interval. Discuss the impact this would have on determining the presence of LNAPL in a well. The product was described as “viscous oil (black &amp; thick)”. Discuss the LNAPL characteristics relative to migration potential and ability to impact groundwater. A lack of LNAPL in the well may not be an appropriate indicator of a lack of LNAPL in the subsurface. Discuss surrounding borings and groundwater monitoring results downgradient of the LNAPL.</p>	<p>Discussion concerning the nature and extent of LNAPL is provided in significant detail in the RI Report, including a description of surrounding borings and groundwater quality data down-gradient of locations with known LNAPL. Additional discussion concerning limitations concerning the LNAPL evaluation due to screen placements has been clearly discussed in the revised text of Section 2.3.1.3. Similarly, Section 2.3.1.3 and related subsections in Section 4 have been updated as requested by EPA to describe the LNAPL (viscous oil-black and thick), and to include a description of the review of soil screening results for surrounding borings. The additional evaluation and the review of boring logs confirms the finding of limited LNAPL</p>



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	extent/mobility at the Facility.
20) Section 2.7.2 – Force Lake Fish Survey – The first paragraph reference to additional information in Appendix H should briefly explain what the appendix presents and if the information is “additional” as information other than what is summarized in the section, or if the appendix information is supporting details that are summarized in the section. Footnote 5 on page 83 is information that should be presented in the text of this section.	Text has been added to clarify the information provided in Appendix H. Footnote 5 on page 83 has been incorporated into the text of the report.
21) Section 2.8.2 – Total DDTs a. The second bullet states that certain values were not selected in an effort to be “conservative.” Please expand the information to identify the objective for selecting values. The discussion should also identify how the analytical results that were selected are considered representative of ambient conditions. b. The values for the low end of the range in Table 2-9, as indicated by footnote, are one-half the reporting limit. The actual reporting limit should be presented without manipulation. For Table 2-10 the discussion should clearly identify if the values have been manipulated/adjusted and the “nd” should be replaced with less than the method reporting limit value. c. As properly stated in the discussion of DDT, the concentrations from the literature search are values that represent a range of possible DDT concentrations in sediment and soil. Concentration values with a similar range of values might be expected within the Study Area. These are “reference” values and not actual background values. The RI should be revised to consistently refer to reference values and not “background” values. Note that the “background” terminology is also used in Attachment 7 of the Draft Final Baseline Human Health Risk Assessment and Attachment 4 of the Draft Final Baseline Ecological Risk Assessment, this should also be changed to “reference values”. d. The comments above apply to Section 2.8.3 – PAHs and 2.8.4 – PCBs and to Table 2-11. Please clarify how the values were selected and please refer to them with a term other than “background.” Use of a phrase such as reference values representing ambient conditions or literature values may be more appropriate.	a. Text was added in the revised RI to indicate the objective for selecting values for reference concentrations. b. The full reporting limits are shown in the revised RI. The full reporting limit values are reported in Table 2-10 and the footnote has been revised. The “nd” in Table 2-10 indicates when reporting limits were not provided in the source documents. This clarification has been added to the revised RI. c. Throughout the RI, HHRA, and ERA, the term “background” has been changed to “reference area” for organic constituents. For metals, the term “background” was retained because specific regional background values have been established. d. Consistent revisions have also been made in Sections 2.8.3 and 2.8.4, and throughout the rest of the RI and risk assessments.
22) Section 3.3.2, p. 91, 2 <sup>nd</sup> to last Par.: Conclusion that pollutants from runoff would stay in Force Lake is too broad and unsupported. Dissolved phase pollutants would discharge via the culverts.	The text referred to in the comment has been updated to include the additional information to support the City of Portland’s conclusion in the Natural Resource Management Plan for Pen 1 regarding the limited transport of constituents to North Lake from Force Lake. Findings from the RI are referenced to indicate that only very limited transport appears to have occurred based on generally low concentrations of constituents in North Lake sediments and on the limited detections in Force Lake surface water (i.e., that dissolved phase constituents are not a major issue).
23) 3.4.2 <i>Local Geology</i> . Foundry sand is noted as being present from 0 to 3 feet. Include and discuss this as a potential source of metals and potential for leaching to groundwater with discharge to surface water. Please include where foundry sand was encountered, as it is not included on the logs.	Research into the origin of “foundry sand” within the text descriptor for the fill soils at the Facility was conducted by the VG in response to this inquiry from the EPA. Background documents as referenced in the RI report were reviewed for reference to “foundry sand” to determine if there was a historical, known source of fill to the property that would include such sand. No such reference was found. In interviewing field personnel who conducted much of the RI field work on the Facility, one individual noted certain observations of blackened soils as “foundry sand” in some of the field records. The individual did not have knowledge of there being “foundry sand” on the property, and used this term as a descriptor. According to a conversation with David Coles on June 16, 2010, Mr. Coles is unaware of any information or observations relative to the Harbor Oil Facility property that would suggest the presence of foundry sand. Based on the preceding research and the conclusion that there is no basis for the presence of foundry sand on the property, the noted reference has been removed/corrected from the sections in the RI Report where it was previously noted.
24) Section 3.5.2 <i>Local Hydrogeology</i> –Perhaps the information being presented in the first bullet is an elevation range above mean sea level. See Table 2-2 and revise to be consistent. The shallow depth of ground water should be presented in other sections, including, but not limited to the Executive Summary.	The information presented in the report often refers to the depth to the base of the shallow water-bearing zone, where elsewhere the depth to the water table is discussed. In order to avoid the confusion this has caused, the text has been revised to clearly refer to the depth/shallow nature of groundwater beneath the site and where depth to the base of this zone is described, it has clearly been referred to as such.
25) Figures 3-1 and 3-2: include the seasonal groundwater elevations and Force Lake on the figures. 26) 3.5.2 <i>Local Hydrogeology</i> . Include a discussion of the relationship between groundwater and surface water (Force Lake and North Lake).	The referenced figures have been revised to depict seasonal low and high groundwater elevations as well as the elevation for Force Lake. Because Figure 3-2 does not include Force Lake, a new cross-section has been prepared that extends to Force Lake so that the relationship groundwater and the surface water in the Lake (shallow groundwater discharge to the Lake) may be better represented.
27) Section 3.5.2.3.2 <i>Aquifer Pumping Test</i> – Please include in this section a brief explanation regarding the inadequacy of the monitoring wells for an aquifer test. Is this related to potential yield, or screen interval or completion depth? In addition, the last paragraph refers to complications from tidal effects in the deep (210 feet bgs) zone. Please explain what is the source of these	Additional explanation has been incorporated into the revised document.

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effects and if the water level in the “slough” and nearby Columbia have variations in water level, from tides, that could affect an aquifer at that depth.	
28) Section 3.6.3 Future Land Uses - This section should clearly state that a potential future land use for the Study Area is a wetlands habitat and recreation area consistent with the information presented in other parts of Section 3.6 and section 3.7.1. Please refer to Specific Comment 5.	The clarification regarding potential future land use within the Study area has been incorporated into the revised document.
29) <i>Table 4.1.</i> Please include LNAPL	LNAPL has been added to Table 4-1 and a discussion of the 2000 LNAPL sample has been added throughout the RI where the 2008 LNAPL sample was discussed.
30) <i>Figure 4-9:</i> Sampling locations SL-36 and SL-28 appear to be switched. Check all figures for accuracy.	A full QC of figures has been completed. See response to general comment 12.
31) <i>Figure 4-11.</i> Include all well locations (extraction wells and wells with LNAPL). Note those wells not sampled due to the presence of LNAPL. Ideally a figure, or inclusion of the extent of LNAPL present could be inserted on figure 4-11.	Figure 4-11 and all other figures that provide groundwater quality data at the Facility have been revised to depict all well locations at the Harbor Oil Facility. A symbol has been added to depict those well locations where LNAPL was present, or has previously been identified (GA-30, EW-1, EW-3). An indication of the magnitude of LNAPL identified is also included (trace to 0.02 feet). Also, a footnote has been added to note which well locations were not sampled as part of the RI and why.
32) <i>Table 4-2:</i> The Table indicates the LNAPL sample depth was 14 feet bgs, this is inaccurate and misleading. The well may extend to 14 feet bgs, but the text and logs indicate the LNAPL is on the surface of the groundwater. Include a table with the analytes evaluated and their respective results for the LNAPL monitoring.	The document has been revised to note that the LNAPL sample was collected from a depth of 2.58 to 2.68 feet bgs.
33) Section 4.1.3.1, Groundwater RSL's: Safe Drinking Water Act Maximum Contaminant Levels should be included.	EPA MCLs and non-zero MCLGs were used in the RI, but were unintentionally omitted from discussion in Section 4.1.3.1. Discussion has been added to the revised RI.
34) Sections 4.2.1 and 4.2.3.2, Discussion of DDT application: Provide substantiation and verification of the DDT application at Vanport. Who (City, State, Federal, Private) specifically directed the spraying, how much was applied, what was the dosage, etc...	Additional information regarding DDT application at Vanport City has been added to the revised RI (application was done by the Housing Authority of Portland, likely a 5 to 10% DDT solution), along with general information regarding historical DDT uses.
35) Section 4.3 – First paragraph, last sentence the information summarizing conclusions of the risk assessment can be deleted as it is not relevant to the discussion.	Text has been revised as suggested.
36) Section 4.3 – Last paragraph; the section could benefit from a summary narrative of methods used to determine the benzo(a)pyrene (BaP) equivalent values for the carcinogenic polyaromatic hydrocarbon (cPAH) compounds. Summary should include the source and reference for the equivalent factors and how the individual analytical results and the values less than reporting limits were processed in the calculations.	The method for calculating the cPAH TEQ has been clarified and a citation has been added to the revised RI.
37) Section 4.3.2 - Constituent Fate and Transport. The five short paragraphs comprising less than a page of information for this section is too brief and does not present the information needed to support the conclusions in other sections of the report. a. The fate and transport discussions in Sections 4.3.2, 4.4.2, 4.5.2, 4.6.2, and 4.7.2 could be moved to a more detailed discussion of fate and transport specific to the Study Area chemicals discussed in Section 5.2. b. There does not appear to be a section that provides a quantitative explanation of properties such as the “high affinity for organic matter.” The chemical characteristic factors (e.g., partitioning coefficients) such as those used in Section 5.2 (for dichlorodiphenyldichloroethane [DDD]) should be identified and tabulated for the site-specific chemicals identified in the fate and transport section of the report. c. The fate and transport discussion should provide a table of the chemical properties, factors, partitioning coefficients, and the site-specific data, such as total organic carbon (TOC) concentrations in soil that are used in Section 5.2. Several sections (6.2.4, 7.1.6.2, 7.2.4, and the Executive Summary) make statement regarding the effect of TOC on the fate and transport of organic chemicals. There is a reference in Section 7.2.4 to a mean value of TOC as 7.1 percent for sediment and in Section 5.2.1.2 to an average TOC of 4.8 percent for subsurface soil. However, there does not appear to be a discussion of the TOC data nor is there a section that quantifies the effects of TOC for DDT in sediment. d. Section 4.3.2 - The third paragraph does not identify which chemicals are being referred to as “non-polar compounds” and should discuss chemicals specific to the Study Area. The fate and transport discussion could benefit from a discussion of other properties such as the tendency for chemicals to bioaccumulate and those chemicals that may be metabolized by organisms and not bioaccumulate. Although there are subsections for the specific chemicals, those subsections do not provide chemical properties to support conclusions in subsequent sections of the report. Other chemical-specific fate and transport discussions, such as Section 4.4.2 for PCBs, and Section 4.6.2 for DDT both refer to Section 4.3.2 as providing the detailed information to support characteristics of fate and transport. Recommend that the fate and transport discussion be put	The requested restructuring of the RI Report has been completed. A table providing a summary of the common fate and transport chemical characteristic factors for site-specific chemicals has been incorporated into the revised text. Additionally, subsections have been added to Section 5 that discuss bioaccumulation potential, bioavailability (including the influence of TOC for non-polar organic compounds), degradation processes, volatility, and solubility. This information was provided to provide the reader with a better understanding of the fate and transport of these constituents, which in turn better supports the CSM.

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in Section 5.2 and the properties presented in a new table in Section 5.	
38) Section 4.3.3.1 references Table 4-4 for chemicals in soil. The correct reference may actually be Table 4-3. Globally check all table and figure call outs with the actual table location and title.	Table reference has been corrected. A full QC of table and figure callouts was conducted.
39) 4.3.3.3 LNAPL 3 <sup>rd</sup> Paragraph: The text states that: “Most constituents discussed in this section were not detected” in referring to LNAPL sampling. Reconcile this with information in Table ES-2 that indicates TPH, PAHs, cPAHs and PCBs were detected in the LNAPL. Also pesticides were detected in 2000 sample. Provide more detail of the actual COPC’s detected in the LNAPL versus a general statement which provides minimal value to describing the characteristics of the LNAPL.	The sentence identified by EPA has been stricken from the document since the description of the testing results stands for itself. Additional discussion has been added to this section of the report, as well as to Sections 4.4, 4.5, 4.6, 4.7, and 4.8 describing the 2000 LNAPL sampling results, which were for select pesticides and PCBs only.
40) 4.3.3.3 LNAPL. Include a complete discussion of LNAPL analysis that met DQOs (2000 E&E and current).	See response to specific comment 39. The requested discussion concerning the 2000 LNAPL analysis has been incorporated into appropriate sections of the report.
41) 4.3.3.3 LNAPL. States “did not identify LNAPL at any boring location.” Field notes indicate that field screening of sample SL-10-6-18 include “product”. Please rectify this discrepancy.	The discrepancy in the text has been corrected and described in the revised report. The finding that LNAPL is only present at limited portions of the Facility and delineated by adjacent borings remains unchanged.
42) 4.4.4 PCB. The summary should describe PCBs and concentrations that were detected in LNAPL.	A description of the results of the PCB sampling of the LNAPL sample has been included in Section 4.4.4 of the revised document.
43) Section 4.8.3.2 mentions plant well B-4. The well referred to is likely PW-01. Check to ensure references are accurate.	The text of the report has been revised to correct this typographical error.
44) Provide a figure showing all groundwater monitoring wells used for characterizing groundwater at the site.	Rather than showing all sampling locations on Figure 2-1, this figure was split into two. The first figure shows soil/sediment locations and the second figure shows groundwater/surface water locations.
45) Section 4, Figures 4-29 through 4-33, 4-36, and 4-39, the screening levels in the legend for surface water are “not detected;” this should likely be changed to “not available.”	“Not detected” is noted in the screening level table in these figures because these constituents were not detected in surface water. Thus, no comparison to criteria was needed. The figures were revised to make this more clear.
46) 4.5.1 and 4.6.1 <i>Known or Suspected Sources and Release Mechanisms</i> . Foundry sand is noted as present at the site in section 3.4.2. Discuss if this is a potential source of metals. These sections make similar statements that agricultural applications that involved the use of some metals (arsenic and copper) and DDT could also account for their presence at the Facility as a result of cattle truck cleaning operations. Discuss this in relation to the fact that Union Stockyard was a historical site owner (Section 1.3.2.4.3 Canal Capital Corp aka Union Stockyards Corp.) and with respect to constituents detected at the Stockyard. This may require additional discussion in section 1.3.3.1 1990 Stockyards Site Investigation.	As described in response to specific comment 23, foundry sands have not been identified, nor are they suspected to be present, at the Harbor Oil Facility. Applicable portions of the report have been revised to correct this error. Therefore, no changes to Section 4.5.1 are necessary to identify foundry sands as a potential contaminant source.  With regard to DDT and the Portland Union Stockyards, the response to specific comment 13 clarifies the additional research identified. Sections 1.3.3.1 was revised to describe these additional research findings and Section 4.6.1 was similarly revised.
47) Section 4.6.4: Inadequate discussion on source of DDT/DDD/DDE in wetland and Force Lake. What does the statement that there is no definitive source data available mean? The purpose of the RI is to determine whether a source exists for the contaminants. The text should discuss whether concentrations are indicative of a spill of product or application for pest control. Elaborate upon this statement and whether the RI data supports the CSM. Also, please distinguish the terms “percent DDT vs total DDT”.	The discussion of the source of DDD/DDE/DDT at the Study Area has been expanded in Section 4.6 to include possible routes for DDT to enter the environment and expected residual concentrations. This section also includes more discussion regarding what conclusion can be drawn from the known information.
48) 4.7.3.3 LNAPL. Text should be phrased more clearly. Were other chlorinated solvents detected that were not discussed in this section. A review of Appendix B (data tables) and Appendix C (Chain of Custodies) could not identify a location where LNAPL analysis was indicated. A search on “GA-30” did not result in any finds. Please indicate where the results of the LNAPL analysis are contained and present them in the text of the RI.	Text in Section 4.7.3.3 has been clarified.  EPA is correct that the LNAPL data table for Appendix B was inadvertently omitted. It has been added in the revised RI. Appendix C contains information regarding the 2008 LNAPL sample, but it should be noted that because the forms in this appendix are from the field, they are handwritten and thus the PDF is not searchable. The following are a few examples of where the LNAPL sample is referenced: page 45 (well development log), pages 169-170 (field notes from May 16, 2008 when sample was collected), and page 272 (COC).
49) 4.8.3.2 <i>Groundwater</i> . The presence of significant concentrations of dissolved iron in the shallow aquifer requires further discussion. An explanation for the low oxygen in the subsurface has not been offered. This may be a natural occurrence or related to elevated organics (contaminants) in the subsurface which are being degraded by microorganisms or some other geochemical process occurring. The RI needs to explain these results.	Discussion concerning the high concentrations of dissolved iron and low dissolved oxygen content of the shallow groundwater zone has been incorporated into Section 4.8.3.2 of the revised report. This information is summarized below.  Concentrations of dissolved iron have been identified in shallow groundwater beneath the Facility at concentrations typically between 20,000 µg/L and 65,700 µg/L. The extent to which iron dissolves in groundwater is primarily a function of the amount of oxygen in the water as well as the general iron content of the materials that comprise the matrix of the water-bearing zone. When levels of dissolved oxygen are low (e.g., less than 1 mg/L), iron has a tendency to occur as Fe <sup>2+</sup> , which will dissolve in water much more readily than the form of iron that is typically present in zones of higher oxygen content (iron oxides).  Dissolved oxygen levels in the shallow, intermediate, and deep groundwater zones, as recorded on groundwater sampling



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	<p>records, were typically less than 0.5 mg/L. Low dissolved oxygen levels are not unusual in groundwater due to a lack of atmospheric mixing and the degradation of organic matter, which could be present as natural organic matter, petroleum, coal, sawdust, plant matter, woody debris, etc. The dissolved oxygen levels in groundwater at the Facility are typical based on experience in the region and do not suggest a unique condition to the Facility.</p> <p>As reported in Table 4-23 of the RI report, total iron concentrations of soil samples collected from within the uppermost groundwater zone were found to have concentrations ranging from 200,000 µg/kg to 280,000 µg/kg, which given the low dissolved oxygen levels, would appear to support and explain the dissolved iron concentrations (20,000 µg/L to 65,700 µg/L) detected in this zone.</p>
<p>50) Section 5.0 Conceptual Site Model: Section is too general and does not provide any specific sources for the contaminants found at the site.</p> <p>a. The bullets in the opening paragraph are specific to the risk assessment process and are best reported in Section 6.1.2 and correlated with Figure 6-1.</p> <p>b. The last paragraph identifies subsections that are not consistent with the body of the report. Please check these and throughout the report for similar inconsistent section identification.</p> <p>c. Section 5.1 fails to provide specific sources for the COPC/COC's at the site, but only general activities. This is insufficient. The CSM should have been verified by the data collection and interpretation of results. There is no mention of the source of PCB's, pesticides or metals in this section, these should be addressed.</p>	<p>Section 5.1 (Sources and Release Mechanisms) has been revised to clearly summarize known or suspected sources of constituents identified in the Study Area based the identified nature and extent of the constituents within the Study Area as well as the known history of activities within the Study Area and surrounding properties. Discussion concerning all constituent groups, including PCBs, DDT, and metals, were specifically addressed in the revised Section 5.1.</p> <p>EPA's suggestion to move bullets in the opening paragraph of Section 5 to Section 6 (Risk Assessment) is understood and appreciated, but these bullets set the stage for the discussion in Section 5.1 and 5.2 and provide linkage to Section 6. For these reasons, the opening paragraph of Section 5 has remained unchanged.</p> <p>A thorough check of referenced subsections within the report has been conducted to ensure that correct and consistent section references are made in the report.</p>
<p>51) Section 5.1 and 5.2 present the release and transport discussion that is typically presented in a "Fate and Transport" section. Section 5 could easily be re-titled "Fate and Transport" and include a subsection (5.1) for the conceptual site model discussion. As mentioned in previous comments to Section 4.3, the chemical properties and "fate" discussion can be combined and presented in Section 5.2.</p>	<p>As per EPA comments on Section 4.3 (see response to specific comment 37), the chemical properties discussion in Section 5.2 has been enhanced and individual discussions of chemical fate and transport as previously included as subsections to Section 4 have been combined into Section 5.2. The name of Section 5 remains "Conceptual Site Model," but Section 5.2 has been renamed "Fate and Transport" to more appropriately describe the function of that subsection.</p>
<p>52) 5.2 <i>Pathways of Migration and Exposure</i>. Preferential pathways from historic site features should be discussed. With regard to wetlands, surface water, and lake sediment an expanded discussion focusing on natural drainages prior to fill and golf course development would be beneficial.</p>	<p>An evaluation of potential preferential pathways of constituent migration from historic site features has been added to the revised RI Report.</p>
<p>53) Section 5.2.1 Groundwater Migration – The depth to groundwater values indicated for the shallow zone (8-15 ft bgs) are inconsistent with measurements reported in Table 2-2 (1-5 ft bgs; 8-15 ft AMSL).</p>	<p>The information presented in the report often refers to the depth to the base of the shallow water-bearing zone, where elsewhere the depth to the water table is discussed. In order to avoid the confusion this has caused, the text has been revised to clearly refer to the depth/shallow nature of groundwater beneath the site and where depth to the base of this zone is described, it has been clearly be referred to as such.</p>
<p>54) 5.2.1 <i>Groundwater Migration</i>. Include a discussion on whether groundwater is discharging to surface water. The section does not indicate groundwater recharges Force Lake, just that it migrates toward Force Lake. Again, the RI is meant to verify the CSM for the Site and should definitively answer these basic issues.</p>	<p>Section 5.2.1 and other applicable Sections of the report have been revised to clearly indicate that shallow groundwater is expected to discharge to Force Lake. New figures and a cross-section have been developed (see response to specific comments 25 and 26) to support this finding.</p>
<p>55) Section 5.2.1.1: The explanation for the presence of DDD in B-4, 2i and 2s is inadequate. There may be other explanations, such as DDD is present in groundwater due to being dissolved in a carrier solvent. Also, the explanation that B-4 is an older well does not address the presence of DDD in 2i and 2s, which are new.</p>	<p>As reported in the RI, total DDT (specifically 2,4-DDD + 4,4-DDD at this location) has been detected in the shallow, intermediate, and deep groundwater zones at the MW-2s/MW-2i/B-4 well cluster location. Total DDT was identified at this location in shallow groundwater at a concentration 0.126 µg/L (total) and 0.073 µg/L (dissolved); in intermediate groundwater at a concentration of 0.015 µg/L (total) and 0.017 µg/L (dissolved); and in deep groundwater at a concentration of 0.012 µg/L (total) and 0.011 µg/L (dissolved). The identified concentrations in all zones were below the lowest human health screening level (0.20 µg/L). EPA conjectures that the presence of DDD at these depths might be a result dissolution in a carrier solvent. A review of data indicates that gasoline-, diesel-, and oil-range petroleum hydrocarbons (hydrocarbon range of typical carrier solvents) have not been detected in groundwater at the MW-2i or the B-4 well locations and therefore this hypothesis does not seem likely.</p> <p>Calculations were presented that demonstrated that transport in the shallow groundwater zone to Force Lake, where shallow groundwater discharge occurs, would require approximately 140,000 years (14,000x retardation factor), by which time complete degradation would have occurred. Using the same retardation factor for potential vertical transport, and using estimated vertical advective velocities between shallow and intermediate and intermediate and deep zones, a DDD migration time between MW-2s and B-4 of approximately 450,000 years was estimated.</p> <p>The MW-2s/MW-2i/B-4 location was drilled through an area of deep DDT impacted soils as identified at 14 to 15 feet bgs in the boring for MW-2S. The construction of well B-4 is in question. The presence of DDT detections at MW-2i (38 to 48 feet bgs) and B-4 (85 to 95 feet bgs) do not correlate with the attenuation calculations as described above. The most likely explanation is that the well seal for well B-4 was breached allowing groundwater from the shallow zone to circumvent the native soils and</p>

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	<p>migrate vertically through the well casing or other potential voids into the intermediate and deep groundwater zones at this location.</p> <p>The preceding is a hypothesis based on observations and known conditions at the Facility and cannot be proven or disproven with available data. Although EPA suggests the occurrence of a breach is significant and suggests the need for immediate action, the concentrations (below human health screening levels) suggested there was time for the 2009 confirmation sampling without resulting in endangerment to human health or the environment.</p> <p>It is recommended that the owner of well B-4 decommission that well in accordance with the requirements of the State of Oregon. The proper decommissioning of this well will eliminate that borehole as a possible conduit for vertical migration.</p>
56) Section 5.2.1.2, Lateral Migration within the shallow groundwater: Include the calculated period of time, in years, it would take DDT and it's metabolites to migrate through soil to Force Lake.	The text has been revised to include the calculated time for DDD and DDT to migrate the distance between the down-gradient property line and Force Lake. For DDD the calculated migration time is 140,000 years, while similar calculations for DDT resulted in a calculated migration time of approximately 700,000 years.
57) Section 5.2: Please include a brief discussion of the potential for migration of chemicals through the food web. The Study Area chemicals compounds include bioaccumulative organics such as PCBs, and pesticides, and inorganics. The discussion can also identify other chemicals such as petroleum hydrocarbons and PAHs that typically are metabolized and do not bioaccumulate.	A discussion of the movement of constituents through the food web (i.e., bioaccumulation potential) has been added to Section 5. Also see response to specific comment 37.
58) 5.2.2 <i>Non-Aqueous Phase Liquid Migration</i> . Reconcile the statement that "LNAPL is not significant at the Facility" with the concern it was present at the site since 2000, and appears to have justified the installation of three extraction wells. Discuss whether product was ever removed from the extraction wells since their installation.	Section 5.2.2 and related portions of the RI report have been revised to describe the fact that LNAPL was first sampled (and therefore identified) in 2000 at well GA-30. At the time of sampling activities in 2008, well GA-30 remained the only well at the Facility with sufficient LNAPL for sample collection. Additional discussion of the rationale for the 2003 LNAPL extraction well installations (precautionary in nature and never used) was also included in the revised RI text.
59) Section 5.2.4, Figure 1-9: The text references a catch basin by N. Victory St. Please include the catch basin on Figure 1-9.	Figure 1-9 has been revised and a reference to this figure has been added to Section 5.2.4.
60) Section 5.2.4, p. 306, 2 <sup>nd</sup> Paragraph: Why the distinction in mentioning "filtered surface water"? Please explain the significance in the text.	The text has been revised to clarify that the filtered water samples are representative of the dissolved phase, thereby clarifying the function of this statement in the context of the overall discussion.
61) Section 5.3, Potential Receptors: At this point the RI should identify the known receptors. This section should be elaborated upon to provide details of known receptors and potential, ie: future, receptors. Issues related to the risk are best reported in Section 6.	Section 5.3 was deleted, and this information was incorporated into Section 6.
62) Section 7 Summary and Conclusions – Previous comments, particularly those for the Executive Summary, are applicable to Section 7.	Changes to other sections of the RI have been carried through to Section 7.
63) 7.1.2 <i>Study Area Investigation</i> . Include what phase of work LNAPL sampling occurred.	Section 7.1.2 was revised to specify that the LNAPL sampling (well GS-30) occurred during the Phase I RI sampling activities in April and May 2008.
64) 7.1.3 <i>Physical Characteristic of the Study Area</i> . Surface features - Include historical topography/surface features. Hydrogeology – include groundwater/surface water interaction.	Section 7.1.3 has been revised to be consistent with earlier responses to EPA comments concerning historical surface features and groundwater/surface water interaction.
65) 7.1.4 <i>Nature and Extent of Contamination</i> . Include a discussion of LNAPL and LNAPL constituents. A discussion about the nature, extent and source of DDT should be presented.	See response to general comment 4. Discussion of LNAPL and DDT sources has been added.
66) Section 7.1.5, 1 <sup>st</sup> Par. After 2 <sup>nd</sup> Bullet: This is a broad and unsupported conclusion of how contaminants migrated. Although storm water runoff is a component of the transport of contaminants, it does not explain the presence of contaminants at depth on the site and within the wetlands. Revise these statements to address the presence of contaminants at depth in Facility soils and Wetland soils.	This text has been revised to provide more information regarding the presence of constituents at depth in Facility and wetland soil. Sumps and holding ponds known to be located along the southwest Facility boundary likely collected wastewater and runoff. These areas were later filled as the Facility was developed.
67) Section 7.3 Evaluation of Preliminary Remedial Action Objectives (RAOs) - CERCLA identifies the RAOs as providing the chemical specific, media specific, and pathway specific objectives for the remedial action (EPA. 1988. Guidance for conducting remedial investigations and feasibility studies under CERCLA. Interim final. EPA/540/G-89/004, OSWER Directive 9355.3). Because this is the RI phase, the chemical-specific cleanup criteria as preliminary remedial goals are not yet needed. However, because we have completed the RI phase, the remedial objectives previously identified in the scoping and work plan phase should be refined and presented in the pertinent section of the RI report. The refined RAOs need to identify the chemicals, media, and pathways that are to be addressed by remedial technologies in the FS. Based upon the summary information presented in Table 7-9, the conclusion can identify if certain initial RAOs are achieved because current and reasonable future conditions are protective, and which RAOs may need to be achieved through remedial alternatives that can be evaluated in the FS.	See response to general comment 5.
68) Section 7 Table 7-9 regarding Facility soil and the berm: There appears to be implication that because the berm is currently vegetated and because RI fieldwork did not observe erosion, that the chemicals in the berm may not migrate and may not present a	See response to general comment 5.

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threat. The current conditions are not a good indication of the future and without specific controls Facility soil, including but not limited to, the berm soil could become exposed and migrate. The information in Table 7-9 should include statements regarding which of the RAOs and site conditions that may need to be addressed by remedial alternatives that can be evaluated in the FS. In addition, “worker exposure” to Facility soil could include the berm soil.	

## 4.6 DDTs

This section presents an overview of source information, fate and transport, and media-specific data for DDTs. Historical records of industrial activities at the Facility did not include any information documenting the use or handling of DDTs at the Facility. However, DDTs have been detected in samples collected from the Study Area, with distribution patterns that suggest that DDTs in a portion of the Study Area may have been released from historical livestock trailer washing operations at the Facility, while DDTs across the larger Study Area may have been released as a result of typical pest control applications in the area.

In the HHRA, total DDTs were identified as a COC based on potential future worker exposure to Facility soil and based on indirect exposure to Force Lake sediment through fish consumption. In the ERA, DDD and DDE concentrations (but not total DDT concentrations) in Force Lake sediments had effects-based HQs greater than 1.0 for invertebrates, and total DDTs in wetland soil had LOAEL-based HQs greater than 1.0 for red-tailed hawk and shrew.

This section discusses total DDTs, which are calculated as the sum of 2,4'-DDD, 4,4'-DDD, 2,4'-DDE, 4,4'-DDE, 2,4'-DDD, and 4,4'-DDD (Appendix N). This section also discusses DDT metabolites, or breakdown products, which include DDD and DDE isomers.

### 4.6.1 Known or Suspected Sources and Release Mechanisms

No specific DDT sources associated with the Harbor Oil Facility have been identified. Although several possible explanations regarding potential sources of DDTs have been hypothesized based on the observed distribution or possible uses of DDTs, there is no definitive information available to confirm any specific source or sources.

Because no definitive source information exists, general information regarding DDTs has been compiled, per EPA request, to provide context to the total DDT concentrations detected within the Harbor Oil Study Area. This general information and available site-specific information is presented in Section 4.6.3, along with a comparison to Study Area data.

### 4.6.2 Constituent Concentrations by Medium

This section presents the concentrations of total DDTs and metabolites in various media within the Study Area. Summary statistics in the tables are provided by location (not sample)<sup>1</sup> to be consistent with the data presented on the figures. The complete RI database is provided in Appendix B.

<sup>1</sup> Duplicate samples were combined with the original sample, as described in Appendix N.

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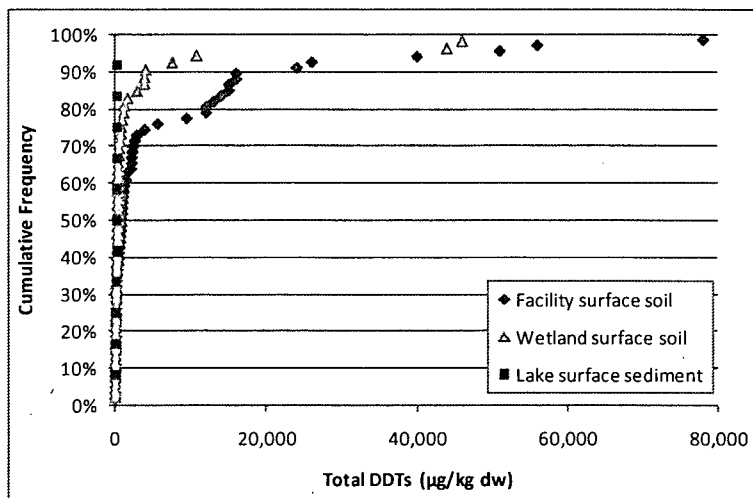
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As discussed previously for other non-polar organic compounds (Section 4.3.2), DDTs generally have a strong affinity for organic matter associated with soil and sediment particles. ¶

Bacteria and fungi can biodegrade pesticides such as DDTs. Degradation rates are dependent upon the characteristics of the aquatic system, concentrations of nutrients, presence of particulate matter, temperature, oxygen concentration, redox potential, microbial populations, and the concentration of the constituent (Sinkkonen and Paasivirta 2000). Under aerobic conditions, DDT biodegrades primarily to DDE; under anaerobic conditions, DDT biodegrades to DDD. DDT and its metabolites are persistent; field and laboratory studies have demonstrated that very little breakdown of DDT occurs in estuarine sediments over the course of 46 days (EXTOXNET 1996). The persistence of DDT in soil is highly variable. Half-lives in temperate regions have been reported to range from 2.3 to 16.7 years. In a study of sprayed forest soils in Maine, the half-life of DDT residues was noted to be 20 to 30 years (Dimond and Owen 1996). ¶ In a study of a freshwater lake, DDT was found to accumulate at higher concentrations in fattier, higher-trophic-level fish than in leaner, lower-trophic-level fish (Kidd et al. 2001). ¶

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Figure 4-34 presents cumulative frequency distributions of total DDT concentrations in surface soil and sediment samples collected from within the Study Area. The data are presented by concentration on the x-axis and by percent frequency within the dataset on the y-axis. For example, approximately 90% of Facility surface soil samples are less than 20,000  $\mu\text{g/kg dw}$ . This figure is intended to help facilitate cross-media comparisons. Total DDT concentrations were highest in Facility soil and lowest in Force Lake surface sediment. Total DDT concentrations in wetland soils were intermediate.



**Figure 4-34. Cumulative Frequencies of Total DDTs Detected in Facility Surface Soil, Wetland Surface Soil, and Force Lake Surface Sediment**

Figure 4-35 presents total DDT concentrations at each soil and sediment location sampled; whereas Figure 4-36 presents total DDT concentrations at each groundwater and surface water location sampled. These data are discussed in the following subsections.

Slipsheet for Figures 4-35 and 4-36 (11 x 17)

**Figure 4-35. Total DDT Concentrations at Facility Soil, Wetland Soil, and  
Lake Sediment Sampling Locations**

**Figure 4-36. Total DDT Concentrations in Unfiltered Samples at Facility  
Groundwater and Lake Surface Water Sampling Locations**

**4.6.2.1 Facility Soil**

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Table 4-16 summarizes concentrations of DDTs in surface and subsurface soil samples collected at the Facility. The depth intervals of these samples varied depending on the sampling location, field conditions, and the sampling event (see Section 2.2). Surface soil samples at the Facility were collected just below the gravel fill layer, if present.



**Table 4-16. Concentrations of DDTs Detected in at least one Facility Soil Sample**

Sample Type <sup>a</sup>	Detection Frequency		Min Detect Conc.	Max Detect Conc.	Location of Max Detect	Mean Conc. <sup>b</sup>	RL or Range of RLs <sup>c</sup>
	Ratio	%					
2,4'-DDD (µg/kg dw)							
Surface	34/43	79	7.4	12,000	SL-36	1,000	2.0 – 540
Intermediate	18/31	58	2.8	5,800	MW-2s	280	1.9 – 20
Deep	4/30	13	2.2	3,400	MW-2i	110	1.9 – 4.9
Soil stockpile	3/3	100	96	250	SP-01	170	na
Soil berm	6/9	67	17	950	SB-01	170	4.9 – 5.0
4,4'-DDD (µg/kg dw)							
Surface	53/56	95	5.0	64,000	DP01	6,000	0.6 – 2.0
Intermediate	28/34	82	2.5	21,000	MW-2s	940	0.86 – 9.7
Deep	10/35	29	1.6 J	14,000	MW-2i	400	0.86 – 4.9
Soil stockpile	3/3	100	310	580	SP-01	440	na
Soil berm	7/9	78	5.0 J	1,900	SB-01	350	4.9 – 27
2,4'-DDE (µg/kg dw)							
Surface	1/43	2	7.0	7.0	SL-09	nc	2.0 – 9,600
Intermediate	0/31	0	nd	nd	nd	nc	1.9 – 990
Deep	0/30	0	nd	nd	nd	nc	1.9 – 2,400
Soil stockpile	0/3	0	nd	nd	nd	nc	5.9 – 24
Soil berm	0/9	0	nd	nd	nd	nc	4.9 – 240
4,4'-DDE (µg/kg dw)							
Surface	22/56	39	1.6	5,200 J	DP01	400	0.6 – 9,600
Intermediate	12/34	35	2.2	160	SL-23	40	0.86 – 990
Deep	1/35	3	5.1	5.1	SL-31	nc	0.86 – 2,400
Soil stockpile	3/3	100	18 J	28 J	SP-01	22	na
Soil berm	4/9	44	66	580	SB-01	97	4.9 – 6.0
2,4'-DDT (µg/kg dw)							
Surface	1/43	2	3.0 J	3.0 J	SL-31	nc	2.0 – 9,600
Intermediate	0/31	0	nd	nd	nd	nc	1.9 – 990
Deep	0/30	0	nd	nd	nd	nc	1.9 – 2,400
Soil stockpile	0/3	0	nd	nd	nd	nc	5.9 – 24
Soil berm	4/9	44	94 J	920	SB-01	160	4.9 – 6.0
4,4'-DDT (µg/kg dw)							
Surface	22/56	39	5.6	8,400	DP01	600	0.6 – 9,600
Intermediate	9/34	26	0.95	2,700	MW-2s	96	0.86 – 97
Deep	1/35	3	23,000	23,000	MW-2i	nc	0.86 – 4.9
Soil stockpile	3/3	100	42 J	130	SP-03	84	na
Soil berm	9/9	100	7.1 J	7,600	SB-01	1,100	na
Total DDTs (µg/kg dw)							
Surface	53/56	95	5.0	78,000 J	DP01	8,000	0.6 – 2.0

**Table 4-16. Concentrations of DDTs Detected in at least one Facility Soil Sample (cont.)**

Sample Type <sup>a</sup>	Detection Frequency		Min Detect Conc.	Max Detect Conc.	Location of Max Detect	Mean Conc. <sup>b</sup>	RL or Range of RLs <sup>c</sup>
	Ratio	%					
Intermediate	28/34	82	2.5	30,000	MW-2s	1,300	0.86 – 20
Deep	10/35	29	1.6 J	40,000	MW-2i	1,100	0.86 – 4.9
Soil stockpile	3/3	100	470 J	940 J	SP-01	720	na
Soil berm	9/9	100	7.1 J	12,000	SB-01	1,900	na

<sup>a</sup> Surface soil samples were collected immediately below the gravel layer from depths of 0 to 5 ft bgs (0.5- to 1.5-ft sampling intervals for a given sample). Intermediate soil samples were collected from depths of 2 to 8.5 ft bgs (1- to 4-ft sampling intervals for a given sample). Deep soil samples were collected from depths of 6 to 22 ft bgs (1- to 4-ft sampling intervals for a given sample). All soil berm samples were collected from 0.5 to 2 ft bgs, and all soil stockpile samples were collected from 0.5 to 6 ft bgs.

<sup>b</sup> The mean concentration is equal to the average of all detected values and one-half of the RL for non-detected values. Mean concentrations were not calculated if the detection frequency was less than 10% or if fewer than three samples had detected concentrations.

<sup>c</sup> RLs are for only non-detected samples.

bgs – below ground surface

DDD – dichlorodiphenyldichloroethane

DDE – dichlorodiphenyldichloroethylene

DDT – dichlorodiphenyltrichloroethane

dw – dry weight

J – estimated concentration

na – not applicable

nc – not calculated

nd – not detected

RL – reporting limit

Total DDTs were detected in 95% of Facility surface soil samples, with detected concentrations ranging from 5.0 to 78,000 µg/kg dw and a mean concentration of 8,000 µg/kg dw. Soil stockpile and soil berm total DDT concentrations were generally lower, with mean concentrations of 720 and 1,900 µg/kg dw, respectively. In Facility subsurface soil samples, total DDTs were detected in 82% of intermediate and 29% of deep samples, with mean concentrations of 1,300 and 1,100 µg/kg dw, respectively. Total DDTs were generally highest in the surface interval, with concentrations decreasing with depth.

A few samples in the northwest portion of the Facility had higher concentrations in the intermediate interval relative to the surface and deep intervals of those samples (e.g., SL-21 and SL-23). At MW-2i, only a deep soil sample was collected, it had a detected concentration of 40,000 µg/kg dw total DDTs. This sample (MW-2i) was collected from an area that was undeveloped during the early history of the Facility and was later filled as the Facility was expanded, which may explain the presence of higher DDT concentrations at depth. In addition, this sample was collected from an area (MW-2i) where DDTs were detected in all shallow, intermediate, and deep groundwater samples, as discussed in Section 4.5.3.3.

Figure 4-35 presents total DDT concentrations in soil at the Facility. Total DDT concentrations were highest (i.e., greater than 10,000 µg/kg dw) in the central portion of the Facility near the former truck cleaning operation, in the C-shaped area to the west of the former truck cleaning operation, and along the southwest boundary of the Facility. Concentrations of DDTs greater than 2,000 µg/kg dw were detected in the north corner of the Facility and in the northwest portion of the Facility near the soil stockpile. The fact that these areas had the highest DDT concentrations suggests that the former truck cleaning operation could have been a source of DDTs at the Facility. In addition, total DDTs were detected at a concentration of 40,000 µg/kg dw in the deep soil sample collected from MW-2i. This sampling location was in an area where historical documents and aerial photographs (Appendix A) suggest that unlined sumps and holding ponds may have been located. As described in Section 4.6.3.5, these features, in conjunction with the predominance of livestock trailer washing activities upslope from this area, may help explain the higher DDT concentrations at depth in this area.

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The available Facility soil data indicate that concentrations greater than the conservative industrial human health RSL (7,700 µg/kg dw) were limited in extent to the central portion of the Facility (e.g., SL-15 and SS05) and to the southwest boundary of the Facility (e.g., DP02 and SS08). Concentrations of DDTs were also greater than the conservative residential human health RSL (1,700 µg/kg dw) in samples near the Facility exit (SL-25 and SS01) and in samples in the west corner of the Facility (e.g., SL-22 and SL-41). Note that the comparison with conservative screening levels on a point-by-point basis should not be viewed as a risk estimate; risks were fully assessed in the HHRA as presented in Appendix I and summarized in Section 6.1. Higher concentrations of total DDTs were generally bounded both vertically and

laterally in Facility soil, indicating that DDTs have been adequately delineated and the available data meet the DQOs identified in the RI/FS Work Plan (Bridgewater et al. 2008).

#### 4.6.2.2 Groundwater

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Table 4-17 summarizes concentrations of detected DDTs in groundwater. Of the six component total DDTs, only two were detected in groundwater, including 2,4'-DDD and 4,4'-DDD.

**Table 4-17. Concentrations of DDTs Detected in at Least One Groundwater Sample**

Sample Type <sup>a</sup>	Fraction	Detection Frequency		Min Detect Conc.	Max Detect Conc.	Location of Max Detect	Mean Conc. <sup>b</sup>	RL or Range of RLs <sup>c</sup>
		Ratio	%					
2,4'-DDD (µg/L)								
Shallow	D	1/4	25	0.014	0.014	MW-2s	nc	0.010
	T	6/22	27	0.0063 J	0.032	MW-2s	0.0082	0.010
Intermediate	D	0/1	0	nd	nd	nd	nc	0.010
	T	1/4	25	0.012	0.012	MW-2i	nc	0.010
Deep	D	0/1	0	nd	nd	nd	nc	0.010
	T	1/3	33	0.0073 J	0.0073 J	B-4	nc	0.010
4,4'-DDD (µg/L)								
Shallow	D	2/4	50	0.011	0.059 J	MW-2s	nc	0.010
	T	12/28	43	0.0071 J	0.24 J	A-20	0.027	0.010 – 0.019
Intermediate	D	1/1	100	0.017	0.017	MW-2i	nc	na
	T	2/4	50	0.015	0.036	MW-2i	nc	0.010
Deep	D	1/1	100	0.011	0.011	B-4	nc	na
	T	2/4	50	0.012	0.014	B-4	nc	0.010 – 0.018
Total DDTs (µg/L)								
Shallow	D	2/4	50	0.011	0.073 J	MW-2s	nc	0.010
	T	12/28	43	0.0071 J	0.24 J	A-20	0.030	0.010 – 0.019
Intermediate	D	1/1	100	0.017	0.017	MW-2i	nc	na
	T	2/4	50	0.015	0.048	MW-2i	nc	0.010
Deep	D	1/1	100	0.011	0.011	B-4	nc	na
	T	2/4	50	0.012	0.021 J	B-4	nc	0.010 – 0.018

<sup>a</sup> The depth of shallow groundwater wells ranged from 10 to 20 ft bgs, the depth of intermediate wells ranged from 48 to 50 ft bgs, and the depth of the deep well was 97 ft bgs.

<sup>b</sup> The mean concentration is equal to the average of all detected values and one-half of the RL for non-detected values. Mean concentrations were not calculated if the detection frequency was less than 10% or if fewer than three samples had detected concentrations.

<sup>c</sup> RLs are for only non-detected samples.

bgs – below ground surface	na – not applicable
D – dissolved water concentration (i.e., filtered)	nc – not calculated
DDD – dichlorodiphenyldichloroethane	nd – not detected
DDT – dichlorodiphenyltrichloroethane	RL – reporting limit
J – estimated concentration	T – total water concentration (i.e., unfiltered)

DDTs were analyzed in unfiltered (i.e., total) water samples from all locations sampled. In addition, a subset of samples collected as part of the Phase 2 RI sampling event were analyzed for DDTs in filtered (i.e., dissolved) samples to evaluate the effect of particulates on DDT concentrations in groundwater. Samples with detectable concentrations of DDTs in unfiltered water generally also had detectable DDT concentrations in the filtered water. Concentrations of DDTs in filtered water ranged from 30 to 100% of the unfiltered water concentration. The fact that DDTs were detected in filtered water samples indicates that concentrations in groundwater samples were not attributable solely to the presence of particulates.

DDTs were detected in shallow groundwater samples in some of the areas where DDT concentrations in soil samples were highest (i.e., greater than 10,000 µg/kg dw) (Section 4.5.3.1), including the central portion of the Facility, the exit driveway, and along the southwest boundary of the Facility (Figure 4-36).

Concentrations of DDTs were detected in deeper groundwater samples from the MW-2s/MW-2i/B-4 well cluster in the south-central portion of the Facility but were not detected in any other groundwater samples collected from intermediate monitoring wells or plant well (PW-01). DDTs were detected in the sample from the intermediate-depth well MW-2i in 2008 and 2009 and in the sample from the deep well B-4 in 2008 and 2009. The soil sample collected at monitoring well MW-2i had a detected total DDT concentration of 40,000 µg/kg dw at a depth of 14 to 15 ft. bgs. Given the low mobility of DDTs, one possible explanation for the presence of DDTs in intermediate and deep wells is that B-4 is an older well established prior to 1990 and may have served as a conduit for the deeper migration of DDTs from surrounding soils. However, the mobility of DDTs in soil is generally low.

No MCL or non-zero MCLG was available for DDTs.

#### 4.6.2.3 LNAPL

As discussed in Section 4.3.3.3, LNAPL is not a significant component at the Facility, and its presence is localized and constrained to a small portion of the Facility.

One LNAPL sample was collected from shallow well GA-30 (uppermost groundwater zone) in the northwest portion of the Facility near the soil stockpile in 2000 (layer thickness unknown) by EPA, and again in 2008 as part of the Phase I RI activities when a thin layer (approximately 0.1 ft) of LNAPL was observed at that location. DDTs were analyzed only in the 2008 sample. No DDTs were detected in the 2008 sample.

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Follow-up monitoring, including a year of monthly measurements, revealed thin layers of LNAPL (0.01 to 0.02 ft) in GA-30, although no LNAPL was observed in downgradient wells GA-29 and MW-1s (see Figure 2-1 for well locations). Thus, the lateral extent of LNAPL appears to be limited to the area immediately surrounding well GA-30.

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#### 4.6.2.4 Wetland and Ditch Soil

Table 4-18 summarizes concentrations of DDTs in wetland and ditch surface and subsurface soil samples.

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**Table 4-18. Concentrations of DDTs Detected in at Least One Wetland and Ditch Soil Sample**

Sample Type <sup>a</sup>	Detection Frequency		Min Detect Conc.	Max Detect Conc.	Location of Max Detect	Mean Conc. <sup>b</sup>	RL or Range of RLs <sup>c</sup>
	Ratio	%					
2,4'-DDD (µg/kg dw)							
Surface	32/47	68	4.2	7,700	WS-39	360	1.9 – 78
Intermediate	8/10	80	6.4	890 J	WS-25	240	2.0
Deep	5/10	50	2.2	53	WS-21	14	1.9 – 2.0
4,4'-DDD (µg/kg dw)							
Surface	49/52	94	2.4 J	27,000	WS-39	900	2.5 – 130
Intermediate	10/10	100	2.6	1,900	WS-25	560	na
Deep	7/10	70	2.4 J	140	WS-20	30	1.9 – 2.0
2,4'-DDE (µg/kg dw)							
Surface	4/47	9	4.5 J	370	WS-25	39	1.9 – 980
Intermediate	0/10	0	nd	nd	nd	nc	2.0 – 960
Deep	0/10	0	nd	nd	nd	nc	1.9 – 39
4,4'-DDE (µg/kg dw)							
Surface	40/52	77	3.8	2,700	WS-25	220	2.4 – 980
Intermediate	8/10	80	3.9	2,400	WS-21	370	2.0 – 20
Deep	5/10	50	4.0	170	WS-21	21	1.9 – 2.0
2,4'-DDT (µg/kg dw)							
Surface	20/47	43	6.6	11,000	WS-25	330	1.9 – 160
Intermediate	2/10	20	740	3,300	WS-25	nc	2.0 – 200
Deep	2/10	20	33	57	WS-21	nc	1.9 – 9.7
4,4'-DDT (µg/kg dw)							
Surface	36/52	69	2.6	27,000	WS-25	890	0.97 – 160
Intermediate	4/10	40	3.0	10,000	WS-25	1,500	2.0 – 200
Deep	2/10	20	110 J	420	WS-21	nc	1.9 – 9.7
Total DDTs (µg/kg dw)							
Surface	51/52	98	2.7 J	46,000	WS-25	3,000	130
Intermediate	10/10	100	13	17,000 J	WS-25	3,100	na
Deep	8/10	80	2.4 J	800	WS-21	130	1.9 – 2.0

<sup>a</sup> Surface soil samples were collected from 0 to 0.5 ft bgs, intermediate soil samples were collected from 0.5 to 1 ft bgs, and deep soil samples were collected from 2 to 3 ft bgs.

<sup>b</sup> The mean concentration is equal to the average of all detected values and one-half of the RL for non-detected values. Mean concentrations were not calculated if the detection frequency was less than 10% or if fewer than three samples had detected concentrations.

<sup>c</sup> RLs are for only non-detected samples.

bgs – below ground surface

J – estimated concentration

DDD – dichlorodiphenyldichloroethane

na – not applicable

DDE – dichlorodiphenyldichloroethylene      nc – not calculated  
DDT – dichlorodiphenyltrichloroethane      nd – not detected  
dw – dry weight      RL – reporting limit

Total DDTs were detected in 98% of surface wetland and ditch soil samples, with detected concentrations ranging from 2.7 to 46,000 µg/kg dw and a mean concentration of 3,000 µg/kg dw. In subsurface soil samples, total DDTs were detected in 100% of intermediate and 80% of deep soil samples, with mean concentrations of 3,100 and 130 µg/kg dw, respectively. As shown in Figure 4-35, DDT concentrations were always highest in the surface interval on a location-by-location basis, with concentrations decreasing with depth.

Figure 4-35 presents total DDT concentrations for wetland and ditch soil. Total DDT concentrations in the wetland and ditch soil were generally similar to or lower than those detected in Facility soil, although the highest total DDT concentrations were detected at the Facility (Figure 4-34). The highest total DDT concentrations in the wetlands were detected at WS-25 and WS-39 (46,000 and 44,000 µg/kg dw, respectively), which are located just southwest of the Facility approximately half way between North Force Avenue and the drainage ditch. Total DDT concentrations were greater than 1,700 µg/kg dw, the conservative residential human health RSL, at other locations in this area (WS-20, WS-21, and WS-40). Concentrations of DDTs were generally low in samples collected from the periphery of the wetlands except for several sampling locations adjacent to North Force Avenue (WS-31, WS-33, and WS-42).

As discussed above, higher concentrations of total DDTs were generally bounded both vertically and laterally in wetland and ditch soil, indicating that DDTs have been adequately delineated and the available data meet the DQOs identified in the RI/FS Work Plan (Bridgewater et al. 2008).

#### 4.6.2.5 Lake Sediment and Surface Water

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Table 4-19 summarizes concentrations of detected DDTs in lake sediment samples. Of the six components of total DDTs, three were detected in lake sediment (2,4'-DDD, 4,4'-DDD, and 4,4'-DDE).

No DDTs were detected in lake surface water samples (RLs for all samples were equal to 0.01 µg/L).



**Table 4-19. Concentrations of DDTs Detected in at Least One Lake Sediment Sample**

Sampling Location	Sample Type <sup>a</sup>	Detection Frequency		Min Detect Conc.	Max Detect Conc.	Location of Max Detect	Mean Conc. <sup>b</sup>	RL or Range of RLs <sup>c</sup>
		Ratio	%					
2,4'-DDD (µg/kg dw)								
Force Lake	surface	8/11	73	8.6 JN	61 JN	SE-05	32	4.8 – 25
	intermediate	0/3	0	nd	nd	nd	nc	1.9 – 2.0
North Lake	surface	0/3	0	nd	nd	nd	nc	23 – 25
4,4'-DDD (µg/kg dw)								
Force Lake	surface	11/11	100	11 J	47	SE-05	37	na
	intermediate	0/3	0	nd	nd	nd	nc	1.9 – 2.0
North Lake	surface	1/3	33	25 J	25 J	SE-101	nc	23 – 25
4,4'-DDE (µg/kg dw)								
Force Lake	surface	11/11	100	9.1	150	SE-06	92	na
	intermediate	1/3	33	4.5	4.5	SE-10	nc	2.0
North Lake	surface	1/3	33	26	26	SE-101	nc	23 – 25
Total DDTs (µg/kg dw)								
Force Lake	surface	11/11	100	22 J	250	SE-06	160	na
	intermediate	1/3	33	4.5	4.5	SE-10	nc	2.0
North Lake	surface	1/3	33	51 J	51 J	SE-101	nc	23 – 25

<sup>a</sup> Surface lake sediment samples were collected from 0 to 4 in. below the mudline, and intermediate lake sediment samples were collected from 2 to 3 ft below the mudline.

<sup>b</sup> The mean concentration is equal to the average of all detected values and one-half of the RL for non-detected values. Mean concentrations were not calculated if the detection frequency was less than 10% or if fewer than three samples had detected concentrations.

<sup>c</sup> RLs are for only non-detected samples.

DDD – dichlorodiphenyldichloroethane

DDE – dichlorodiphenyldichloroethylene

DDT – dichlorodiphenyltrichloroethane

dw – dry weight

J – estimated concentration

N – tentative identification

na – not applicable

nc – not calculated

nd – not detected

RL – reporting limit

Total DDTs were detected in 100% of surface sediment samples collected from Force Lake, with concentrations ranging from 22 to 250 µg/kg dw and a mean of 160 µg/kg dw. The mean total DDT concentration in Force Lake surface sediment (160 µg/kg dw) was significantly less than the mean concentration in Facility surface soil (8,000 µg/kg dw) and was well below the mean detected concentration in wetland surface soil (3,000 µg/kg dw) (Figure 4-34).

Total DDTs were detected in one of the three subsurface (intermediate and deep) sediment samples collected from Force Lake, at a concentration of 4.5 µg/kg dw. These data indicate that the vertical extent of DDTs is limited. In addition, total DDTs were detected in one of the

three surface sediment samples collected from North Lake, at a concentration of 51 µg/kg dw.

Concentrations in surface sediment were all less than the invertebrate screening level for total DDTs. However, as discussed in Section 6.2 and Appendix J (ERA), the concentrations of DDE and DDD were greater than screening levels at some of the sediment sampling locations (see Section 5.1.1 in Appendix J for a full discussion).

#### **4.6.3 Percent Contribution of DDD, DDE, and DDT**

In addition to the distribution of total DDT concentrations, the percent contribution of DDD (2,4'-DDD or 4,4'-DDD), DDE (2,4'-DDE or 4,4'-DDE), and DDT (2,4'-DDT or 4,4'-DDT) was also examined. Because of the tendency of DDT to break down into DDD and DDE (Section 4.6.2), a low percent DDT may indicate an old source or may indicate higher rates of DDT degradation.

As shown in Figure 4-37, throughout most of Facility, in the west portion of the wetlands, and in Force Lake sediment, the percent DDT was very low (less than 20% DDT). Locations with the highest percent DDT (greater than 60%) include the soil berm and some nearby samples, one location in the northwest portion of the Facility near the stockpile (SL-22), two locations southwest of the Facility in the wetlands (WS-27 and WS-40), and two locations just west of the ditch in the wetlands (WS-13 and WS-15). With the exception of WS-25, all samples with higher percent DDT were surface soil samples. At location WS-25, the surface, intermediate, and deep wetland soil samples all contained greater than 60% DDTs. These areas of high percent DDT do not correspond with areas with higher total DDT concentrations, indicating that percent DDT is not a function of total DDT concentrations.

Slipsheet for Figure 4-37 (11x17)

**Figure 4-37. Percent Contribution of DDT to Total DDTs (DDD, DDE, and DDT) in Facility Surface Soil, Wetland Surface Soil, and Lake Surface Sediment Samples**

As previously noted, areas with low percent DDTs may indicate areas impacted by an older release, although DDT degradation rates may vary greatly based on environmental conditions. The soil berm, an area with higher percent DDTs, was constructed around the northwest and southwest sides of the Facility after the 1979 Facility fire, apparently from soil impacted by releases caused by this fire.

#### 4.6.4 General DDT Information for Comparison to Study Area Data

Until it was banned in the United States in 1972, DDTs were widely used to control both agricultural and disease-causing pests. Thus, DDTs were released to the environment through their direct application and in association with DDT production and waste disposal. This section discusses the residual concentrations associated with these pathways to provide general context to Study Area concentrations.

##### 4.6.4.1 Residual Concentrations Associated with DDT Production or Disposal

DDTs were produced at many sites within the United State prior to their ban in 1972. Some of these sites are now Superfund sites that have data regarding residual concentrations of DDTs. Two Superfund sites were identified with DDT residue information (ATSDR 2002), and a third site (Farmcraft), was identified because of its regional relevance. These sites are summarized below.

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- Baird and McGuire Superfund Site (Holbrook, MA): At this site, DDT contamination was the result of over 60 years of DDT production. In a 1985 study, average concentrations of DDD, DDE, and DDT were 70,000, 10,000, and 61,000 µg/kg dw, respectively. Summing these averages would result in a total DDT concentration of 141,000 µg/kg dw.
- Palos Verde Shelf (Los Angeles, CA): DDT contamination at this site was the result of discharge at this location from a DDT manufacturer. A 1996 study reported surface sediment concentrations of DDD, DDE, and DDT ranging from 10,000 to 38,000, 16,000 to 372,000, and non-detect to 8,000 µg/kg dw, respectively. Using these numbers, approximate total DDT concentrations could have ranged from 26,000 to 418,000 µg/kg dw.
- Farmcraft Facility (Tigard, OR): Farmcraft operated as a pesticide formulation facility between 1953 and 1983. They received raw ingredients (e.g., DDT, talc, diesel), and then formulated, packaged, and distributed pesticides. DDT concentrations in the site soil in 1993 were as high as 4,700,000 µg/kg dw, or about 0.5% (DEQ 2008).
- Rhodia Facility (Portland, OR): On-site disposal of pesticide wastes occurred on this property within two ponds from the 1940s through 1990. The Oregon DEQ reports concentrations of 4,4'-DDT in soil at this property of up to 3,100,000 µg/kg dw. Note that no total DDT concentrations were reported.
- Arkema Facility (Portland, OR): Pennwalt, Inc. manufactured DDT at this property during the late 1940s and early 1950s. Concentrations of 4,4'-DDT in surface soils greater than 1,200,000 µg/kg dw have been reported, with a maximum 4,4'-DDT concentration of 150,000,000 µg/kg dw reported in the DEQ database for a sample collected in 1994. Note that no total DDT concentrations were reported.

#### **4.6.4.2 Residual Concentrations Associated with Agricultural Applications**

A few studies identified through a literature search provided information related to residual concentrations in soils following agricultural applications. A 1966 study of DDT residues in orchard soil found that three New Jersey orchards contained an average of 113 pounds of DDT per acre, most of which was in the top 4 inches of the soil (Terriere et al. 1966). Assuming loosely packed soil (75 lbs per cubic foot), this would correspond with a DDT concentration of approximately 70,000 to 100,000 µg/kg dw (DDT in the top 4 to 6 inches of soil) at the time of the study in 1966. These concentrations would likely be significantly lower now following almost 40 years of degradation (DDT was banned in 1972).

A more recent study from 1998 of residual DDT concentrations in soil after agricultural applications in British Columbia, Canada, reported DDT concentrations from 194 to 763 µg/kg dw in silt loam soils and 2,984 to 7,162 µg/kg dw in muck soils (Aigner et al. 1998; as cited in ATSDR 2002), indicating the dependence of the degradation rate on the soil type or environmental conditions (DDT tends to be more persistent in muck soils than in drier soils).

#### **4.6.4.3 Residual Concentrations Associated with Pest Control**

DDT was also commonly used in pest control applications throughout the United States. DDT was used in nearby Vanport City by the Housing Authority of Portland as a method of pest control in the 1940s (Maben 1987). A DDT spray (likely 5 to 10% DDT based on typical applications (Bureau of Medicine and Surgery 1944)) was used at apartments to combat insect and rodent infestations. Further, a July 9, 2010 discussion with Mr. Chris Wirth, Program Manager for Multnomah County Vector and Nuisance Control, indicates that Multnomah County would have used a DDT spray mixture in the county for mosquito control prior to the banning of DDT in 1972 (Wirth 2010). Mr. Wirth noted that the County does not have records of the volumes of pesticides that were used, or the locations that were sprayed with DDTs, but that the vector program (at that time called the City of Portland Insect Control Bureau), would have used such formulation as it was the standard of the day.

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While insufficient information is available to estimate residual soil concentrations associated with activities described above, a 1944 manual on DDT insecticide use discusses recommended application rates of DDT for controlling various pests (e.g., mosquitoes and bedbugs) (Bureau of Medicine and Surgery 1944).

For mosquito control, it was recommended that 0.5 to 1 lb of DDT be applied per acre (5 to 10% DDT in kerosene or oil). Under the same assumptions as for the New Jersey orchard described above (loosely packed soil and DDTs in the top 4 to 6 inches), residual concentrations of DDTs in soil would range from approximately 300 to 900 µg/kg dw at the time of application.

Similarly, for bedbug control, it was recommended that 250 cubic cm of a 5% DDT-kerosene spray be used to treat each bed, which is equivalent to 0.025 lbs of DDT per bed. Assuming a high density of apartments (100 beds per acre), as was the case at Vanport City near the Study Area (Maben 1987), this could translate into approximately 2.5 lbs of DDT per acre and a residual total DDT concentration of approximately 2,000 µg/kg dw. With regard to duration of application, Vanport was constructed in 1943 and was destroyed in 1948 by flooding, at which time spraying for bedbugs would have ceased. Although

Vanport was no longer present subsequent to 1948, spraying in the area for mosquito control can reasonably be assumed to pre-date and post-date Vanport's existence.

The calculations above for both mosquito and bedbug control are for a single application; periodic applications were likely necessary to maintain the effectiveness of the insecticide. The Manual on DDT insecticide noted that DDT was effective in preventing bedbugs for 6 months or more (Bureau of Medicine and Surgery 1944). Assuming a twice-annual application rate over 30 years (DDT was commonly used starting in 1939 until its ban in 1972), DDT concentrations could have ranged from 9,000 to 60,000 µg/kg dw in shallow soils for pest control.

Note that all estimated concentrations in this section are highly uncertain and are based on a number of assumptions. The duration of use or frequency of application would affect the residual DDT concentrations as would the degradation rates and time since application, among other factors.

Also of note, the Portland Union Stockyard, located to the north of the Facility, operated from 1910 to 1988 (Section 4.2.3.3). While it is possible that DDTs were used or transferred onto this property in relation to the pest control for livestock, a review of available history and investigation work at the stockyard property (Section 1.3.3.1) identified no discussion concerning the use of DDTs and no analysis of environmental samples for DDTs. Thus, no information is available to confirm whether DDTs were used at the stockyard. The use of DDT for pest control related to livestock (control of cattle lice or ticks, for example) was a widely used practice prior to it being banned in 1972. Literature suggests that DDT would typically be applied at a concentration of 0.5% to 5% in a liquid solution or 10% as a dust. For liquid application to cattle, between 0.5 gallons and 6 gallons of the DDT mixture might be required per animal per application to sufficiently wet the animal. There are too many variables involved to estimate a resulting DDT concentration in soil that might get tracked into a livestock transport trailer, but the preceding information does describe a plausible mechanism for the identified DDT concentrations in soil proximate to the former truck cleaning operation at the Facility.

#### **4.6.4.4 Urban DDT Concentrations in Stormwater**

The above sections discussed residual DDT concentrations associated with the production, disposal, and use of DDTs prior to its ban in 1972. Even though DDT production and use is no longer authorized, DDT is persistent in the environment and is still commonly detected in environmental samples. Stormwater catch basin samples collected as part of the draft Portland Harbor RI (Integral et al. 2009) provide an indication of typical urban levels of DDTs in Portland associated with various land uses:

- Heavy industrial: 4.8 to 160,000 µg/kg dw (n=18)
- Light industrial: 34 µg/kg dw (n=1)
- Major transportation: 3.4 to 17 µg/kg dw (n = 2)
- Mixed land use: 6.3 to 180 µg/kg dw (n=6)
- Open space: 3.9 µg/kg dw (n=1)

- Residential: 36 to 260 µg/kg dw (n=3)

#### 4.6.4.5 Comparison of General DDT Information to Study Area Concentrations

General information regarding the prevalence and concentration of DDTs in areas where DDTs were historically produced or disposed, where DDTs were historically applied for agricultural or pest-control treatment, and in present-day urban areas (based on stormwater catch basin samples) was compiled in Section 4.6.1.2. While this general information, which is by no means exhaustive, provides general context for the concentrations detected in the Study Area, it does not identify specific sources for the DDT concentrations in Facility and Study Area.

For example, total DDT concentrations ranged from 22 to 250 µg/kg dw in Force Lake surface sediment (mean of 160 µg/kg dw) (Table 4-19). The total DDT concentrations in stormwater catch basin samples from Portland (Integral et al. 2009) ranged from 3.4 to 260 µg/kg dw, illustrating that the total DDT concentrations in Force Lake sediments are not atypical of the general level of DDT found in urban environments.

With respect to soil, total DDT concentrations were highly variable at the Facility and in the wetland, and ranged from 0.6 to 78,000 µg/kg dw in Facility surface soil (mean of 8,000 µg/kg dw) and from 2.7 to 46,000 µg/kg dw in wetland surface soil (mean of 3,100 µg/kg dw) (Tables 4-16 and 4-18; Figure 4-35). Even the highest of these concentrations were at the low end of the ranges reported for sites where DDTs were produced or where production-related waste was disposed (26,000 to 4,700,000 µg/kg dw).

The 1998 British Columbia study of residual DDT concentrations from past DDT applications also reported lower residual concentrations (194 to 7,162 µg/kg dw depending on soil type); these concentrations are similar to the majority of samples within the Study Area. Because the adjacent Vanport City area was known to have been treated with DDTs in the past to control bed bugs, and the Study Area may have been sprayed for mosquito control by the Portland Insect Control Bureau, it is possible that the DDT concentrations throughout much of the Study Area reflect residual concentrations from these known or suspected treatments.

Explanations for the higher DDT concentrations in the central Facility area are also speculative. However, based on the Facility history, the most likely source of DDTs in this area is the former cattle truck cleaning operation. It is known that pesticides, including DDTs, were commonly used at livestock yards for vector and insect control, typically by dusting, spraying, or dipping the animals. Trucks that were cleaned at the Facility may have been contaminated with DDTs associated with livestock applications, which could have resulted in the presence of DDTs in wash water from cleaning operations. Wash water would have migrated via sheet flow to other parts of the Facility (Section 4.2.1) and may have accumulated in sumps, holding ponds and low areas that were historically located near the southwest Facility boundary (which likely extended into what is now considered the wetlands). This theory may best explain the distribution of DDTs in that portion of the Study Area.

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#### 4.6.5 Summary for DDTs

In the Study Area, total DDT concentrations were highest in surface soils collected at the Facility. In Facility soil, DDTs were highest in the central portion of the Facility near the former truck cleaning operation, in the C-shaped area to the west of the former truck cleaning operation, and along the southwest boundary of the Facility.

In the wetlands, total DDT concentrations were generally similar to or lower than those at the Facility (Figure 4-34): the mean total DDT concentration in Facility surface soil samples was 8,000 µg/kg dw as compared with the mean concentration of 3,000 µg/kg dw in surface soil samples collected in the wetlands. The highest DDT concentrations in the wetlands were located just southwest of the Facility boundary, in close proximity to the highest DDT concentrations detected at the Facility. These high concentrations of DDTs may be the result of the migration of wash water from the truck washing operation, off of the Facility via sheet flow. This water may have accumulated in historical sumps and holding ponds along the southwest Facility boundary, which extended into what is now considered the wetlands.

Moderate DDT concentrations detected in samples near the former stormwater system discharge point and in the drainage ditch indicate that DDTs from truck washing operations may have also entered the wetlands via stormwater runoff.

Lower concentrations of DDTs (in the range 2.7 to 280 µg/kg dw) were detected in lake sediment and in the wetlands to the west of the drainage ditch. The lower DDT concentrations in this area may not be associated with the Facility, although no specific information is available to confirm this hypothesis. Possible explanations for these lower concentrations of DDTs in that part of the Study Area may be related to the following:

- DDTs may have migrated from the former truck cleaning operation to other parts of the Study Area. Concentrations may be lower in the west wetlands because of the drainage ditch (constructed as a hydraulic control to prevent Facility stormwater from discharging into the northwestern portion of the wetlands) and may be lower in Force Lake because the wetlands could have acted as a buffer for the migration of chemicals.
- The documented use of DDTs for pest control in the adjacent Vanport City and the possible use of DDT for mosquito control within the Study Area and surrounding region could explain the presence of DDT concentrations (Section 4.6.1.1) at those portions of the Study Area.
- Typical DDT applications in the region for agricultural or pest control use from the early 1940s to 1972. As discussed in Section 4.6.1.2, DDT concentrations in Portland area stormwater catch basin samples are similar to the lower concentrations at the Study Area, indicating the possibility that general urban use of DDTs was a contributor to DDT concentrations in some areas.

Thus, while information is not available to definitively identify the source of DDTs at the Study Area, using a weight-of-evidence approach, the highest

**Deleted:** The only documented use of DDTs near the Study Area was as a method of pest control in Vanport City in the 1940s (Maben 1987). A concentrated DDT spray was used at apartments to combat insect and rodent infestations. Soils contaminated with DDTs may have been re-distributed throughout the Study Area during the May 1948 flood, but there is no definitive information available regarding the potential re-distribution of DDTs as a result of the 1948 flood.

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concentrations may be the result of truck cleaning operations that began in the 1950s when DDT use was common. The history of the Facility and the concentrations patterns at the Study Area generally indicate that the source or sources are historic, and that no continuing source of DDTs exists.

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**Deleted:** One possible source is the documented use of DDTs in Vanport City and the potential for the spread of DDT-contaminated soils during the 1948 flood. Vanport City was originally located to the southwest of Force Lake (i.e., across the lake from the Facility), but the flood may have redistributed DDT-contaminated soils into Force Lake and the wetlands based on the extent of the flood as shown in the 1948 aerial photograph (Appendix A). DDTs in Force Lake may also have originated from operations at the Facility, with the lower concentrations indicating that the wetlands have acted as a buffer for the migration of chemicals into Force Lake; however, no definitive source data are available.<sup>1</sup>

## References

- Aigner E, Leone A, Falconer R. 1998. Concentrations and enantiomeric ratios of organochlorine-pesticides in soils from the U.S. corbel. *Environ Sci Tech* 32:1162-1168.
- ATSDR. 2002. Toxicological profile for DDT, DDE, DDD [online]. Agency for Toxic Substances and Disease Registry, Atlanta, GA. [Cited 9/7/06.] Available from: <http://www.atsdr.cdc.gov/toxprofiles/tp35.html>.
- Bridgewater, GeoDesign, Windward. 2008. Remedial investigation/feasibility study: work plan for the Harbor Oil site. Prepared for the Voluntary Group for the Harbor Oil Site RI/FS. Bridgewater Group, Inc., Lake Oswego, OR; GeoDesign Inc., Portland, OR; Windward Environmental LLC, Seattle, WA.
- Bureau of Medicine and Surgery. 1944. Manual on DDT insecticide. Navy Department, Washington, DC.
- DEQ. 2008. Memorandum dated January 14, 2008 from L. Garner, DEQ Project Manager, to Farmcraft site file, ECSI 1223 and 1597: staff report and proposal for partial and conditional no further action for Farmcraft Facility (former), 8900 SW Commercial Street and the adjacent Union Pacific Railroad right-of-way in Tigard, OR. Oregon Department of Environmental Quality, Portland, OR.
- Integral, Windward, Kennedy/Jenks, Anchor. 2009. Portland Harbor RI/FS: Remedial investigation report. IC09-0003. Prepared for Lower Willamette Group. Integral Consulting, Inc., Mercer Island, WA; Windward Environmental LLC, Seattle, WA; Kennedy/Jenks Consultants, Portland, OR; Anchor Environmental, LLC, Portland, OR.
- Maben M. 1987. Life in Vanport. Chapter two, pp 22-31 in *Vanport*. Oregon Historical Society Press, Portland, OR, reprinted by permission at Exploring the Columbia Slough [online]. Center for Columbia River History, Vancouver, WA. [Cited 2/18/10.] Available from: <http://www.ccrh.org/comm/slough/primary/lifeatvp.htm>.
- Terriere LC, Kiigemagi U, Zwick RW, Westigard PH. 1966. Persistence of pesticides in orchards and orchard soils. In: Rosen A, et al, eds, *Organic pesticides in the environment*. Advances in Chemistry series. American Chemical Society, Washington, DC.
- Wirth C. 2010. Personal communication (phone conversation with R. Ede, Hahn and Associates, regarding spraying of DDTs for mosquito control in Portland, OR). Multnomah County Vector and Nuisance Control, Portland, OR. July 9, 2010.

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FOR THE HARBOR OIL SITE, PORTLAND OREGON, APRIL 7, 2010  
DRAFT VOLUNTARY GROUP RESPONSES – JULY 23, 2010

EPA Comment	Voluntary Group Response
<b>Baseline Ecological Risk Assessment</b>	
1. The report provided for this review was in track change format. It is suggested a thorough QA/QC check for consistency purposes be performed before finalizing the report.	A thorough QC was completed before the submittal of the draft final baseline HHRA. Additional checks was done after the redline text was accepted.
2. Figure 5-1 COPC Concentrations in Surface Sediment Samples Relative to Sediment Thresholds for Aquatic Benthic Invertebrates: there is a large amount of information presented, it is recommended that the figure be printed on a larger size paper, rather than 8.5-inch by 11-inch when prepared for the final report.	Figure 5-1 was revised and is now presented as an 11x17-sized figure.
3. Page 215, Section 5.2.1.3 Risk Conclusions for Surface Water, and page 220, Section 5.2.2.3 Risk Conclusions for Sediment: In addition to these two pages, it is stated several times that “Barium sediment concentrations in Force Lake were less than national background concentrations.” Please direct readers/reviewers to a reference, or include the barium national background concentrations for each medium. Alternatively, tabulate these values and provide a reference citation as an appendix.	A comparison of barium background and Study Area concentrations was added to the text.
4. Page 251, Second Paragraph: In the first line of the paragraph, it states that the average concentration of total PCBs were 78 µg/kg dw or less; moving to the fourth line, it states that an average concentration of total PCBs was 75 µg/kg dw. Please clarify how the average of 75 µg/kg dw was selected. Or is this a typographic error?	The text has been clarified in the revised draft final ERA.
<b>Baseline Human Health Risk Assessment</b>	
<b>General Comments</b>	
1. The repeated references in the Executive Summary and Section 5 to EPA’s “acceptable risk threshold” should be deleted. The upper and lower boundaries of the target risk range or 10 <sup>-4</sup> to 10 <sup>-6</sup> should not be presented as discrete lines. Further, EPA’s Policy for Risk Characterization (EPA, 1995) notes that risk assessors “are charged with (1) generating a credible, objective, realistic, and balanced analysis; (2) presenting information on hazard, dose-response, exposure and risks; and (3) explaining confidence in each assessment by clearly delineating uncertainties and assumptions along with the impacts of these factors...on the overall assessment. They do not make decisions on the acceptability of any risk level for protecting public health or selecting procedures for reducing risks.”	The Voluntary Group understands that there are many considerations that must be accounted for when determining whether a risk is acceptable or unacceptable and is willing to change the language used in the draft final HHRA. The term “target risk range” was used instead of “acceptable risk range.”
2. Hazard indices (HI) in the Executive Summary and in Section 5 should always be presented as discrete values, particularly when the HI is greater than 1. Merely noting that a cumulative HI is greater than 1 provides little useful information to risk managers and other users of the risk assessment.	The presentation of HQs and HIs was added to the revised baseline HHRA in the ES and in Section 5. However, as noted in the HHRA, the total HQ is not directly interpretable for risk assessment because it includes HQs across multiple endpoints. A total HQ of less than 1 indicates that no endpoint-specific HIs would exceed 1, and thus it was not necessary to calculate HIs. However, when the total HQ was greater than 1, endpoint-specific HIs were calculated by summing the HQs for constituents with common toxicological endpoints to provide the reader with more useful information regarding non-cancer risks. Thus, in some cases, total HQs were presented (when less than 1) and in other cases, HIs were presented (when total HQs were greater than 1).
<b>Specific Comments</b>	
1. <u>Conceptual Site Model and Exposure Assessment, Section ES.2, page ES-2:</u> As noted in specific comments on Section 5.3.3.2, EPA disagrees with the conclusion in this and other sections of the risk assessment that uncertainties associated with estimating COPC concentrations in indoor air preclude quantification of risk and hazard, and specific risk and hazard estimates for this pathway should be presented in the risk assessment.	As discussed with EPA during the July 8, 2010 conference call, this language has been revised and no longer states that risks associated with indoor air concentrations cannot be calculated.
2. <u>Conceptual Site Model and Exposure Assessment, Section ES.2, page ES-2:</u> The discussions presented here and on page ES-3 appear to suggest that human receptors are absorbing soil and groundwater through the skin, rather than absorbing chemicals via dermal contact with various environmental media. The text should be revised to correctly note that dermal absorption of chemicals can occur due to direct contact with soil or groundwater.	Text has been clarified in the revised draft final HHRA.
3. <u>Conceptual Site Model and Exposure Assessment, Section ES.2, page ES-4:</u> The added text notes that “to be conservative,” an exposure point concentration was calculated as one-half the maximum reporting limit if greater than the maximum detected concentration or if the chemical was not detected. It is not clear how this process is “conservative,” as there is equal probability that the actual concentration may be greater than one-half the detection limit. The basis for the statement needs to be clarified or the additional text deleted.	The phrase “to be conservative” has been deleted as suggested by EPA.

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4. <u>Risk Characterization and Uncertainty Analysis, Section ES.4, page ES-4:</u> The text in the first paragraph should be revised to clarify that exposure, and ultimately cancer risk is estimated over a 70 year lifetime, not that exposure is 70 years. The second paragraph should be revised to clarify that it is the non-cancer effects that exhibit a threshold, not those chemicals that exhibit non-cancer health effects. If the same chemical also can exhibit a cancer effect, it may do so without threshold.	Text in the revised draft final HHRA was clarified regarding the 70 year averaging time for cancer risks (i.e., that this is not the exposure duration) and regarding the non-cancer effects.
5. <u>Calculating Totals, Section 2.2.4, Page 17:</u> Clarify the rationale for calculating a total TPH concentration based on the sum of the various TPH fractions, and how and where these values are used in the risk assessment. This process is particularly confusing as there are no screening criteria presented for total TPH.	As discussed during the July 8, 2010 conference call, total TPHs were not included in the HHRA, and thus the text in Section 2.2.4 has been deleted in the revised HHRA.
6. <u>Conceptual Site Model, Section 3.1, page 20:</u> It is not clear why the revised text in this section indicates that the vapor intrusion evaluation was evaluated in a different manner than other scenarios. The evaluation of all exposure pathways involves a degree of uncertainty in estimating exposure concentrations for either direct or indirect exposures. The methodology used to estimate indoor air concentrations is consistent with that process, and the revised text should be deleted.	As discussed during the July 8, 2010 conference call, EPA guidance (2002) does not recommend calculating soil vapor concentrations from soil samples. Instead, groundwater concentrations were compared to the available screening levels (EPA 2002). This comparison is presented in the revised HHRA, rather than the comparison using DEQ's vapor intrusion RBCs.
7. <u>Industrial (Construction/Trenching) Worker RME Scenario, Section 3.1.1, page 25:</u> Insufficient explanation is provided in the Draft Final BHHRA regarding the use of the Johnson and Ettinger model for evaluating outdoor worker exposure to chemicals volatilized from soil and/or groundwater during construction/trenching activities. The J&E model estimates indoor air concentrations by accounting for convective air flow into an enclosed building via a perimeter crack between the floor and foundation walls. The convective air flow is induced by a negative pressure within the structure caused by a combination of wind effects and stack effects due building heating and mechanical ventilation. There is no explanation of how the J&E model was modified to account the lack of mechanical air flow and building air exchange rate or other needed inputs to the J&E model. Hence, EPA has little confidence in the estimated exposure concentrations of volatile contaminants in breathing air. A detailed explanation of how the J&E model was used to estimate air concentrations in a setting without buildings, along with the technical justification of the modifications is needed.	Additional details regarding the equations, parameters, and methodology used to calculate outdoor air concentrations for assessing inhalation risks for the industrial (construction/trenching) worker RME scenario have been added to the revised draft final HHRA. The RISC software, which is commonly used by EPA in California, was used because it provides a streamlined approach for calculating air concentrations from soil and groundwater samples. Further research into the RISC software showed that the outdoor air model relies on a box model to estimate concentrations in outdoor air, not the J&E model. Text has been revised for clarification in the HHRA and in Attachment 4, which discusses the calculation of outdoor air concentrations.
8. <u>Future Outdoor Worker RME Scenario, Section 3.1.2, page 26:</u> Inhalation of COPCs entrained on windborne dust should be quantitatively evaluated in the risk assessment using the methodology outlined in Section 3.3.1.	The Voluntary Group maintains that risks from the inhalation pathways (inhalation of soil vapors and soil particles) are insignificant (i.e., complete but not significant) as compared to direct contact with soil. However, as agreed during the July 8, 2010 conference call, risks from the inhalation of airborne dusts and vapors from soil have been added to the future outdoor worker RME scenario.
9. <u>Force Lake Recreational User RME Scenario, Section 3.1.4, and Force Lake Fish Consumer RME Scenario, Section 3.1.5, pages 29-32:</u> The text in the second paragraph of Section 3.1.5 contains the conclusion that only recreational anglers are considered the only group likely to be fishing at Force Lake. By definition, this represents a recreational activity, and it is not clear how exposures associated with other recreational activities would not occur concurrently with accessing Force Lake for fishing. Hence, the risk assessment should also present cumulative risk and hazard from all recreational exposures, in addition to evaluating ingestion of fish as a separate exposure.	Cumulative risks from recreational activities (exposure to wetland soil, lake sediment, and lake surface water) and Force Lake fish consumption are presented in Table 5-35 of the HHRA. Per EPA comments on the fish survey results memorandum (June 10, 2009), EPA stated that it should not be assumed that only recreational anglers would use Force Lake. Thus, the fish consumer scenario was not specifically designated as a recreational scenario. A reference to the cumulative risk estimate in Table 5-35 was added to the revised draft final HHRA.

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<p>10. <u>Constituent Screening Evaluation, Section 3.2, pages 31-33:</u> Total petroleum hydrocarbons (TPH) detected in soil should be evaluated in this step. Toxicity criteria representing various TPH fractions are available from several sources, including supplemental PPRTV values. These criteria should be used to derive risk-based soil screening levels for TPH fractions for use on the COPC screening step, and if needed, risk characterization.</p>	<p>The draft final HHRA evaluated total petroleum hydrocarbons (TPH) by evaluating risks from individual chemicals, which included key TPH component chemicals (e.g., naphthalene, benzene, toluene, etc.), and by comparing the concentrations of the three TPH fractions with Oregon DEQ's <i>Risk-Based Decision Making for the Remediation of Petroleum-Contaminated Sites</i> (2003) in the uncertainty assessment.</p> <p>During the July 8, 2010 conference call with EPA, it was requested that this approach be amended to also include the assessment of the aliphatic component of TPHs as potential chemicals of potential concern (COPCs) in the HHRA. The approach to be used was left up to the Voluntary Group to propose based a review of various guidance documents.</p> <p>The Voluntary Group is proposing the following approach, which is consistent with EPA's TPH guidance (2009a). First, the "aliphatic concentration" would be estimated by assuming a percent of each fraction (i.e., gasoline, diesel, and motor oil) is aliphatic. Based on information presented in ATSDR (1999), 85% of each fraction would be assumed to be aliphatic (the midpoint of the range of 80 to 90% presented in ATSDR for various petroleum products). Next, the estimated "aliphatic concentrations" would be compared to screening levels for each TPH fraction from Oregon DEQ's <i>Risk-Based Decision Making for the Remediation of Petroleum-Contaminated Sites</i> (2003). This comparison is conservative because the DEQ risk-based concentrations (RBCs) for the three TPH fractions are for the combined aromatic and aliphatic components. If the "aliphatic concentration" for a specific fraction is greater than fraction-specific RBCs, then that aliphatic fraction would be considered to be a COPC for a given scenario. For the TPH fraction/scenario combinations that screen in as COPCs, toxicity values from EPA's 2009 <i>PPRTV for complex mixtures of aliphatic and aromatic hydrocarbons</i> (2009a) would be used to calculate risk estimates. Note that in this guidance, the aliphatic TPH fractions are separated into low carbon range, medium carbon range, and high carbon range. These ranges would be assumed to be equivalent to the gasoline, diesel, and motor oil ranges, respectively, which are available in the Harbor Oil dataset.</p>
<p>11. <u>COPCs for Vapor Intrusion Scenario, Table 3-4:</u> Per EPA guidance (2002), vapor intrusion need only be evaluated for volatile chemicals, generally defined as having a molecular weight less than 200 g/mole and a Henry's Law constant greater than <math>1 \times 10^{-5}</math>. Exclusion of chemicals that cannot by definition pose a vapor intrusion risk will enhance the clarity of the risk assessment.</p>	<p>To aid in the clarity of the risk assessment, the Voluntary Group has limited the COPC list in the revised draft final HHRA for the industrial/commercial worker vapor intrusion scenario to only those chemicals with molecular weights less than 200 g/mole and a Henry's Law constant greater than <math>1 \times 10^{-5}</math>. Based on these criteria, lead, cPAHs, total PCBs, and total DDTs were not considered to be COPCs for the industrial/commercial worker vapor intrusion scenario.</p>
<p>12. <u>Inhalation of Soil/Water During Industrial (Construction/Trenching) Work, Table 3-11:</u> Inhalation exposures should be evaluated using the methodology outlined in RAGS Part F (EPA, 2008), eliminating the need to estimate inhalation rates, as discussed in Section 3.1.1. Correct the equation in the table so that it clearly denotes that it calculates a time-weighted exposure concentration in air. In addition, the information in the table should be revised to clarify that the inhalation pathway refers to airborne respirable dust particles and chemicals volatilized from water. Inhalation of water (aspiration) is an acute, potentially life-threatening hazard.</p>	<p>The revised draft final HHRA has been revised to show that the methodology outlined in RAGS Part F (EPA 2009b) was used to calculate risks for the industrial (construction/trenching) worker RME scenario. The text has also been clarified to state that the inhalation pathway refers to airborne respirable dust particles and constituents volatilized from soil and water.</p>
<p>13. <u>Dermal Absorption Fractions, Section 3.3.4:</u> The information presented in this section and in Table 3-20 is confusing. The text should be revised to clarify that the procedures described here applies to direct contact with soil, not just sediment. Further, the rationale and procedure for using the values labeled as "oral absorption adjustment" in Table 3-20 need to be clearly described.</p>	<p>Text was revised to clarify that the procedures described in Section 3.3.4 applied to both sediment and soil exposure. Additionally, more narrative regarding the oral absorption adjustment was added to clarify the use of these values, as described in EPA guidance (EPA 2004; Section 4-2 and Exhibit 4-1).</p>
<p>14. <u>Toxicity Assessment, Section 4.0:</u> Some of the information presented in Tables 4-1 through 4-4 is either incorrect or incomplete. Where incorrect toxicity criteria was used for COPCs, chemical-specific risk and/or hazard estimates and cumulative risk and hazard totals will need to be recalculated.</p>	<p>The Voluntary Group has made the changes indicated by EPA in specific comments 15 to 18, and has made the necessary adjustments to the risk estimates throughout the document. These changes do not result in significant increases in risk estimates.</p>
<p>15. <u>Table 4-1:</u></p> <ul style="list-style-type: none"> <li>a. Aluminum – the critical effect for derivation of the PPRTV RfD is neurological effects, the uncertainty factor is 100.</li> <li>b. Arsenic – inorganic arsenic is not a surrogate. Is there some reason to expect organic arsenic compounds at the site?</li> <li>c. Cobalt – the critical effect for derivation of the PPRTV RfD is decreased iodide uptake, the uncertainty factor is 300.</li> <li>d. 1,1-Dichloroethane – the critical effect for derivation of the RfD is increased urinary enzyme markers, the uncertainty factor is 3000.</li> <li>e. <i>n</i>-Propylbenzene – the PPRTV recommendation is use of the RfD for ethylbenzene of 0.1 mg/kg-day as a surrogate value for screening purposes</li> </ul>	<ul style="list-style-type: none"> <li>a. This information was added to Table 4-1.</li> <li>b. Toxicity information is presented in IRIS for inorganic arsenic. The notation of inorganic arsenic as a surrogate is intended to clarify which toxicity information was used, not what forms of arsenic are present at the Study Area. This point was clarified in the revised baseline HHRA.</li> <li>c. This information was added to Table 4-1.</li> <li>d. This information was added to Table 4-1.</li> <li>e. The surrogate for <i>n</i>-propylbenzene was changed to ethylbenzene in the revised draft final HHRA. The Voluntary Group would like to note that benzene was selected as the surrogate for <i>n</i>-propylbenzene as a conservative assumption (benzene is more toxic than ethylbenzene).</li> </ul>

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<p>16. <u>Table 4-2:</u></p> <p>a. Cobalt – the critical effect for derivation of the RfC is respiratory tract irritation and decreased lung function, the uncertainty factor is 300.</p> <p>b. <i>n</i>-propylbenzene – the PPRTV recommendation is use of the RfC for ethylbenzene of 1 mg/m<sup>3</sup> as a surrogate value for screening purposes</p> <p>c. 1,2,4-trimethylbenzene – the critical effect for derivation of the RfC is decreased blood clotting time, and the uncertainty factor is 3000.</p> <p>d. <i>trans</i>-1,2-dichloroethene – the critical effects for derivation of the RfC is pulmonary capillary hyperemia, distention of the alveolar septum, and fatty degeneration of the liver, and the uncertainty factor is 3000.</p>	<p>a. This information was added to Table 4-2.</p> <p>b. The surrogate for <i>n</i>-propylbenzene was changed to ethylbenzene in the revised draft final HHRA. The Voluntary Group would like to note that benzene was selected as the surrogate for <i>n</i>-propylbenzene as a conservative assumption (benzene is more toxic than ethylbenzene).</p> <p>c. This information was added to Table 4-2.</p> <p>d. This information was added to Table 4-2.</p>
<p>17. <u>Table 4-3:</u></p> <p>a. Carcinogenic PAHs – clarify that the slope factor for benzo(a)pyrene is used in conjunction with the PEFs presented in Table 2-5 and describe methodology for deriving the BaP-equivalent slope factor for the other PAHs.</p> <p>b. <i>n</i>-propylbenzene – the EPA weight of evidence classification for <i>n</i>-propylbenzene is Inadequate information to assess carcinogenic potential. Hence, it is not appropriate to use benzene as a surrogate and apply the oral cancer slope factor.</p> <p>c. Trichloroethene – current Region 10 guidance recommends adjusting the Cal EPA inhalation unit risk and oral slope factor upwards by a factor of 10 to 2E-5 (µg/m<sup>3</sup>)<sup>-1</sup> and 0.13 (mg/kg-day)<sup>-1</sup>, respectively, when using the Cal EPA values (EPA, 2008).</p> <p>d. Vinyl chloride – the slope factor and inhalation unit risk values for continuous lifetime exposure during adulthood, rather continuous exposure from birth should be used for the occupational scenarios evaluated for Harbor Oil.</p>	<p>a. A footnote was added to clarify why benzo(a)pyrene is the appropriate toxicity value to use for cPAHs (i.e., that PEFs are used to calculate the cPAH TEQ).</p> <p>b. Per EPA's direction, <i>n</i>-propylbenzene was not evaluated for carcinogenic effects in the revised draft final HHRA. As discussed during the July 8, 2010 conference call, EPA provided a copy of the PPRTV document for <i>n</i>-propylbenzene and this citation was added to the revised HHRA.</p> <p>c. The oral cancer slope factor and inhalation unit risk for trichloroethene have been updated as requested by EPA in the revised draft final HHRA.</p> <p>d. The oral cancer slope factor for vinyl chloride has been updated to the value based on continuous lifetime exposure during adulthood for the occupational scenarios.</p>
<p>18. <u>Table 4-4:</u></p> <p>a. Naphthalene – consistent with EPA guidance (EPA, 2003a), the Cal EPA IUR of 3.4E-5 (µg/m<sup>3</sup>)<sup>-1</sup> should be used.</p> <p>b. Ethylbenzene – EPA does not currently recommend that ethylbenzene be quantitatively evaluated for carcinogenic effects via inhalation exposures.</p> <p>c. <i>n</i>-Propylbenzene – as noted in our comment regarding Table 4-2, the EPA weight of evidence classification for <i>n</i>-propylbenzene is Inadequate information to assess carcinogenic potential. Hence, it is not appropriate to use benzene as a surrogate and apply the oral cancer slope factor</p> <p>d. Trichloroethene – as previously noted, EPA Region 10 recommends use of the Cal EPA IUR adjusted upward by a factor of 10 to 2E-5 (µg/m<sup>3</sup>)<sup>-1</sup>. Alternately, an IUR of 2.5E-5 (µg/m<sup>3</sup>)<sup>-1</sup>, based on the geometric midpoint of the slope factor range from the 2001 TCE risk assessment, may be used.</p> <p>e. Vinyl chloride – the IUR of 4.4E-5 (µg/m<sup>3</sup>)<sup>-1</sup> listed in IRIS should be used.</p>	<p>a. The IUR for naphthalene has been updated to the Cal EPA value of 3.4E-5 in the revised draft final HHRA.</p> <p>b. Per EPA's direction, ethylbenzene was not evaluated for carcinogenic effects pathway in the revised draft final HHRA because it is listed as a class D carcinogen in IRIS.</p> <p>c. Per EPA's direction, <i>n</i>-propylbenzene was not evaluated for carcinogenic effects in the revised draft final HHRA.</p> <p>d. The inhalation unit risk for trichloroethene has been updated as requested by EPA in the revised draft final HHRA.</p> <p>e. The IUR for vinyl chloride has been updated to the value based on continuous lifetime exposure during adulthood for the occupational scenarios of 4.4E-6. Note that it appears that there was a typo in EPA's comment; the value listed in IRIS for continuous adult exposure is 4.4E-6 (not 4.4E-5).</p>
<p>19. <u>Risk Characterization, Section 5.0, page 91:</u> Revise the text in the second paragraph to clarify that the Harbor Oil risk assessment evaluated risk to persons exposed to COPCs present at the Study Area for 25 years, not through exposure over a 70 year lifetime as stated.</p>	<p>Text in the revised draft final HHRA was clarified to ensure that the reader understands that the 70-year duration discussed in Section 5.0 is the averaging time for cancer risks, not the exposure duration.</p>
<p>20. <u>Risk Estimate Calculations, Section 5.1, pages 91-92:</u> The method for calculating risk and hazard presented in these sections is confusing, and should more clearly note that the chronic daily intakes for inhalation exposure are expressed in time-weighted concentrations of either µg/m<sup>3</sup> or mg/m<sup>3</sup> instead of mg/kg-day as shown, and that IURs and RfCs are expressed in µg/m<sup>3</sup> or mg/m<sup>3</sup>, respectively.</p>	<p>Clarification regarding the differences in the calculations of dermal/oral and inhalation risk estimates was added to the revised draft final HHRA.</p>
<p>21. <u>Risk Estimate Calculations, Carcinogenic Risks, Section 5.1.1, page 92:</u> The calculation presented in Equation 5-2 is not correct for estimating cancer risks from early life exposure to carcinogens that act via a mutagenic mode of action. EPA believes that increased risk is associated with exposures up to 16 years of age, not 6 years as calculated here. Consistent with EPA guidance (EPA, 2005), age-dependent adjustment factors to the cancer slope factor – 10 for exposures before 2 years of age – 3 for exposures between 2 and &lt;16 years of age are to be combined with age-specific exposure estimates. Further, it is not clear from Equation 5-2 how the age-dependent exposure calculations described in Section 3 have been incorporated, as the age classes used in that evaluation differ from those present in this section. Cancer risks associated with COPCs known to be mutagens need to be recalculated consistent with EPA guidance.</p>	<p>As discussed with EPA during the July 8, 2010 conference call, EPA's concern with Equation 5-2 relates to the scenario duration as noted in specific comment 23 (not that the equation itself is incorrect for calculating risks for children ages 0 to 6 that act via a mutagenic mode of action). The response to this comment will be revised based on the resolution of the specific methodology to be used to calculating child and adult lifetime exposure risks.</p> <p>See response to specific comment 23.</p>
<p>22. <u>Risk Characterization Format, Section 5.2, page 93:</u> EPA does not object to the presentation of chronic daily intake calculations to 2 significant figures. However, unless information is provided to support the conclusion that the calculations are indeed accurate to such a degree, the statement should be deleted.</p>	<p>The statement in question regarding the significant figures for the CDI calculations was deleted.</p>

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EPA Comment	Voluntary Group Response
<p>23. <u>Risk Estimate Calculations, Force Lake Recreational User, Section 5.3.4, pages 92-118:</u> The overall exposure duration for recreational users has not be clearly defined either in Section 3 or in this section. It is reasonable to assume that recreation users largely consist of nearby residents, and that a 30 year exposure duration is consistent with the 6 years as a child and 24 years as an adult presented in this section. Since cancer risk is proportional to the duration of exposure, exposure and risk incurred as a child and as an adult must be summed.</p>	<p>In the draft final HHRA, separate adult and child scenarios (with exposure durations of 30 years and 6 years, respectively) were used to evaluate risks for the Force Lake recreational user scenario. This approach was consistent with the Portland Harbor HHRA (recreational beach user scenario and fish consumption scenarios) and with the Lower Duwamish Waterway HHRA (seafood consumption scenarios). Per EPA comments on the draft final HHRA (specific comment 21) and as discussed during the July 8, 2010 conference call, an integrated lifetime exposure scenario will be used instead.</p> <p>This integrated exposure risk estimate will be calculated in three age groups for all COPCs: young children ages 0 to 6, older children ages 7 to 16, and adults ages 17 to 30, based on EPA guidance (EPA 1991, 2005). Risk estimates for each age group will be provided and discussed and the three age groups will be summed to calculate the lifetime excess cancer for each COPC.</p> <p>Note that for chemicals with mutagenic modes of action (i.e., carcinogenic polycyclic aromatic hydrocarbons [cPAH] toxic equivalents [TEQ]), EPA's 2005 guidance will be followed to calculate the excess cancer risk for the child age groups before the risks for all age groups are summed. This method for calculating the excess cancer risk will be applied to the first two ages groups of the lifetime exposure scenario (ages 0 to 6 and 7 to 16), as recommended in the guidance.</p>
<p>24. <u>Risk Estimate Calculations, Force Lake Fish Consumer, Section 5.3.5, pages 118-122:</u> As previously noted, fishing at Force Lake is a recreational activity that would be done in conjunction with other recreational activities. Thus, risks and hazard estimates should be summed for these exposure pathways.</p>	<p>See response to specific comment 9. A reference to the cumulative risk estimates for recreational exposure and fish consumption (Table 5-35) was added to this section.</p>
<p>25. <u>Page 122, First Paragraph, Second Line:</u> It states, "As shown in Table 5-31, the excess cancer risk estimate for arsenic based on the regional background concentration was greater than the Study Area risk...." However, Table 5-31 shows an arsenic cancer risk of <math>8 \times 10^{-6}</math> for the Study Area and a cancer risk of <math>8 \times 10^{-6}</math> to <math>9 \times 10^{-6}</math> for the background. Thus, the words "greater than" should be changed to "similar to."</p>	<p>This change was made in the revised draft final HHRA.</p>
<p>26. <u>Hypothetical/Future Facility Building, Section 5.3.3.2, pages 107-108:</u> EPA (2002a) does not recommend the use of bulk soil samples for quantitative evaluation of vapor intrusion. The 2002 guidance presents tables of various vapor intrusion screening levels for both soil gas and groundwater. In order to assess the need for further evaluation in the absence of soil gas data for the Harbor Oil site, equilibrium vapor concentrations may be calculated from soil concentrations using information presented in Section 2.2 of EPA, 2003b. The resulting soil gas concentrations may then be compared to the risk-based screening levels presented in EPA's Vapor Intrusion guidance or other acceptable screening criteria. Note that EPA Region 10 currently does not concur with use of the Oregon DEQ-derived risk-based concentrations for vapor intrusion, and this evaluation should be conducted consistent with EPA's guidance.</p>	<p>See response to specific comments 1 and 6. As discussed during the July 8, 2010 conference call, EPA guidance (2002) does not recommend calculating soil vapor concentrations from soil samples. Instead, groundwater concentrations were compared to the available screening levels (EPA 2002). This comparison was added to the revised HHRA, rather than the comparison using DEQ's vapor intrusion RBCs.</p>
<p>27. <u>Hypothetical/Future Facility Building, Section 5.3.3.2, pages 107-108:</u> EPA disagrees with the conclusion in this and other sections of the risk assessment that uncertainties associated with estimating COPC concentrations in indoor air preclude quantification of risk and hazard. The risk assessment presents no information why exposure estimates for other pathways are presumed to have a greater inherent accuracy. Accordingly, risk and hazard for the vapor intrusion pathway should be quantitatively evaluated in the risk assessment.</p>	<p>See response to specific comments 1 and 6. As discussed with EPA during the July 8, 2010 conference call, this language has been revised and no longer states that risks associated with indoor air concentrations cannot be calculated.</p>
<p>28. <u>Hypothetical Future Resident Screening Assessment, Attachment 1:</u> The screening assessment should quantitatively evaluate risk and hazard. Guidance for estimating total risk from multiple chemicals is available at: <a href="http://www.epa.gov/reg3hwmd/risk/human/rb-concentration_table/usersguide.htm">http://www.epa.gov/reg3hwmd/risk/human/rb-concentration_table/usersguide.htm</a>. Suitable screening values for assessing risk from vapor intrusion are available as from EPA. 2002.</p>	<p>As discussed with EPA during the July 8, 2010 conference call, the residential screening assessment has been revised to provide a better estimate of the total risk. Maximum concentrations were compared to cancer and non-cancer residential RSLs. Exceedance factors were calculated for each constituent and were summed to provide a general estimate of the total risk. The results of this assessment have been added to the revised HHRA and RI.</p>
<p>29. <u>Methods for Calculating Fish Tissue Concentrations, Attachment 2:</u> Provide a rationale for the selection of a default BSAF of 1 for chemicals for which values were not located in the referenced sources. Information presented in Section 6.1.4 regarding the basis for selection of specific BSAF values should be presented in this attachment, along with a discussion of the rationale for selecting specific values for use in the risk assessment. In addition, further discussion is needed regarding the rationale for selecting the BSAF for benzo(a)pyrene as representative of all carcinogenic PAHs, rather than a weighted average as was done for DDT/DDD/DDE.</p>	<p>The requested information has been added to Attachment 2 text and tables, including the basis for the selected BSAF values and additional information regarding the selection of a default BSAF of 1.0. Additionally, information was added to clarify why the BSAF for benzo(a)pyrene is the appropriate value for cPAH TEQ.</p> <p>These changes was also made to the revised draft final ERA.</p>



U.S. ENVIRONMENTAL PROTECTION AGENCY COMMENTS ON THE DRAFT FINAL BASELINE ECOLOGICAL RISK ASSESSMENT AND DRAFT FINAL HUMAN HEALTH RISK ASSESSMENT  
FOR THE HARBOR OIL SITE, PORTLAND OREGON, APRIL 7, 2010  
DRAFT VOLUNTARY GROUP RESPONSES – JULY 23, 2010

EPA Comment	Voluntary Group Response
30. <u>Calculation of Inhalation Risks, Attachment 4:</u> As noted in EPA's original comments, the modifications to the Johnson and Ettinger (J&E) model contained in the Risk-Integrated Software for Cleanup (RISC) is not appropriate for evaluating vapor intrusion risks at NPL sites, and no supporting documentation of the equations and model assumptions is provided. As described, the methodology used in the RISC software appears inconsistent with current EPA guidance for assessing inhalation risks (EPA, 2009), and it appears to employ outdated toxicity criteria. Indoor air concentrations may be estimated using default attenuation factors presented in EPA's Vapor Intrusion Guidance (2002), or using EPA's versions of the J&E model, available at <a href="http://www.epa.gov/oswer/riskassessment/airmodel/johnson_ettinger.htm">http://www.epa.gov/oswer/riskassessment/airmodel/johnson_ettinger.htm</a> . If the J&E model is used, any variations from default the default input parameters regarding soil and building properties must be provided.	As discussed in response to specific comment 12, the revised draft final HHRA has been revised to show that the methodology outlined in RAGS Part F (EPA 2009b) was used to calculate risks for the industrial (construction/trenching) worker RME scenario.  All references to toxicity values taken from RISC and risk calculations done in the RISC software have been removed from the revised draft final HHRA. The RISC model is now used and referenced only in relation to the calculation of outdoor air concentrations (see response to specific comment 7).
31. <u>Background Concentrations, Attachment 7:</u> As noted in EPA's original comments on the risk assessment, EPA does not believe sufficient information has been provided to justify use of data collected from the Radio Tower site to support derivation of anthropogenic background concentrations for PAHs. Additionally, a more detailed discussion of the Oregon DEQ Columbia Slough project is required to justify use of information from that study as anthropogenic background for both PAHs and PCBs. As noted on page 1, the values presented in the Columbia Slough report represent calculated values. Information regarding appropriate characterization of background and comparing site and background data is presented in EPA, 2002b.	Per RI specific comment 21, throughout the RI, HHRA, and ERA, the term "background" has been changed to "reference area" for organic constituents. For metals, the term "background" was retained because specific regional background values have been established for this constituent group by DEQ. The revised language no longer states that the Radio Tower site represents anthropogenic background concentrations for PAHs or that the DEQ Columbia Slough project concentrations for PAHs and PCBs represent anthropogenic background concentrations.
32. The report provided for this review was in track change format. It is suggested a thorough QA/QC check for consistency purposes be performed before finalizing the report.	A thorough QC was completed before the submittal of the draft final baseline HHRA. Additional checks was done after the redline text was accepted.
<b>Minor Comments</b>	
1. The text on page 32 (Section 3.2) has been revised from referring to risk-based concentrations (RBCs) to regional screening levels (RSLs). The text in the associated footnote should be revised to also reflect this change.	The footnote has been updated in the revised draft final HHRA.
2. Page 33, Section 3.2.1, footnote 6 should be revised to reflect changes in associated text.	The footnote has been updated in the revised draft final HHRA.
3. N-Nitroso compounds should be designated with a capital N to denote the presence of a nitrogen atom. Use of a lower-case n refers to stereoscopic structure.	The HHRA was revised to use a capital "N" as directed by EPA.

## REFERENCES

- ATSDR. 1999. Toxicological profile for total petroleum hydrocarbons (TPH). Agency for Toxic Substances and Disease Registry, Atlanta, GA.
- DEQ. 2003. Risk-based decision making for the remediation of petroleum-contaminated sites. Oregon Department of Environmental Quality, Portland, OR.
- EPA. 1991. Risk assessment guidance for Superfund: Volume 1- Human health evaluation manual (Part B, development of risk-based preliminary remediation goals). Interim. EPA/540/R/99/003. Office of Emergency and Remedial Response, US Environmental Protection Agency, Washington, DC.
- EPA. 2002. OSWER draft guidance for evaluating the vapor intrusion to indoor air pathway from groundwater and soils (subsurface vapor intrusion guidance). EPA530-D-02-004. US Environmental Protection Agency, Office of Solid Waste and Emergency Response, Washington, DC.
- EPA. 2004. Risk assessment guidance for Superfund: volume 1—Human health evaluation manual (Part E, supplemental guidance for dermal risk assessment). Final, July 2004. EPA/540/R/99/005. Office of Emergency and Remedial Response, US Environmental Protection Agency, Washington, DC.
- EPA. 2005. Supplemental guidance for assessing susceptibility from early-life exposure to carcinogens. EPA/630/R/03/003F. Risk Assessment Forum, US Environmental Protection Agency, Washington, DC.
- EPA. 2009a. Provisional peer-reviewed toxicity values for complex mixtures of aliphatic and aromatic hydrocarbons and xylenes. Superfund Health Risk Technical Support Center, US Environmental Protection Agency, Cincinnati, OH.
- EPA. 2009b. Risk assessment guidance for Superfund: volume 1—Human health evaluation manual (Part F, supplemental guidance for inhalation risk assessment). EPA/540/R/070-002. Office of Superfund Remediation and Technology Innovation, US Environmental Protection Agency, Washington, DC.



U.S. ENVIRONMENTAL PROTECTION AGENCY COMMENTS ON DRAFT REMEDIAL INVESTIGATION STUDY FOR THE HARBOR OIL SITE, APRIL 7, 2010  
VOLUNTARY GROUP DRAFT RESPONSES – JULY 28, 2010

EPA Comment	Voluntary Group Response
<b>General Comments</b>	
1. The conclusions and the remedial action objectives (RAOs) in the Executive Summary (ES.7) and in Section 7 are relatively dismissive of the findings from the residential exposure evaluation. The conclusion of the residential exposure evaluations, although in ES6.1 text, is not presented as a key finding and is omitted from the Executive Summary Conclusions. Please include the potential risk posed by the site if residential exposure was assumed. If this requires the development of a quantitative Risk Assessment for residential exposure, that should be done using standard residential exposure scenarios provided for in EPA guidance. EPA acknowledges that the future anticipated land-use is not residential, but the information is required to assure the Site record provides adequate information to inform potential future development in inappropriate changes of land use at the Site.	Discussion of the results of the residential screening analysis has been added to Section ES.7 and to Section 7. This comment is related to HHRA specific comment 28 and RI specific comment 3.  This comment was discussed during the June 24 call with EPA. EPA is not requesting a formal residential scenario, but instead wants the RI to provide sufficient information in the RI in case there is a request for a change in land use in the future. Revisions will be made to the current screening assessment to compare RSLs with maximum detected concentrations; EPCs already calculated as part of the HHRA may also be compared to RSLs. The screening assessment will still be presented as an appendix to the HHRA.
2. The report makes mixed and inconsistent use of Study Area and Site. Revisions should be made to clarify and use Study Area as appropriate. There does not appear to be a clear or functional use of "Site." Sample locations figures should be revised to define the Study Area boundary. It is not clear how North Lake is related to the Study Area and it should be addressed either by the boundary or in a narrative explanation. For example, Figure 1-2 indicates that North Lake is outside of the Study Area boundary; however, sediment samples were collected from North Lake and thus it is part of the Study Area.	Terminology RI has been clarified by stating that the Site (as defined in the AOC) includes the Facility, wetlands & Force Lake. The term "Study Area" will be used to describe the entire sampled area (which includes a portion of North Lake). Because the exact boundary of the Site has not been determined, the term "Study Area" will be used throughout the RI.
3. Throughout the report there is specific reference made to "Facility-related" chemicals and/or chemicals of concern (COCs). These statements are not supported by rationale or by an identified list of the constituents. Use of the phrase obscures the meaning of the information being conveyed and the term should be either removed, or defined in one or more sections. For one example of the potential confusion in the information reported, please see Section 7.3 where the RAO statement appears to refer appropriately to "Study-Area COCs" but the Table 7-9 discussing the RAOs uses "Facility-related" chemicals. The report should clarify if there are Study-Area COCs that are not Facility-related chemicals.	All references to "Facility-related chemicals" have been removed to improve clarity. Text now refers to "constituents," the term that is used throughout the RI.  <i>2 ok, but COC's are still used</i>
4. The Conceptual Site Model fails to address the source of COPC's and COC's at the facility and within the study area adequately. Speculative assumptions are inappropriate for a Remedial Investigation and need to be substantiated with literature references or field verification. For example, the RI should definitively address whether use of DDT by the City of Portland or another entity, such as the Stockyards, occurred in the area through archival research, interviews, etc.	The discussion of the source of DDD/DDE/DDT at the Study Area (Section 4.6.1) has been expanded to include possible sources of, and routes for, DDT to enter the environment and expected residual concentrations based on document review and other information. This section also has been expanded to include more discussion regarding conclusions that can be drawn from the suspected historical DDT uses in the area in conjunction with known DDT concentrations and distribution in the Study Area. <i>OK</i>
5. The RI report ends without a discussion of data limitations and recommendations for future work and without a clear path forward for the remedial objectives in the FS phase. Table 7-9 and Section 7 presents a summary of information and technical facts but do not provide a focus on whether the Study Area or Facility require further action or evaluation. The recommendations should include, but not be limited to, whether or not certain RAOs are achieved based upon existing conditions that may be protective of the specific receptors and exposure scenarios; whether or not groundwater monitoring is needed to further support remedial decision; and whether or not the non-aqueous phase liquid (LNAPL) as petroleum on groundwater surface requires periodic measurements and or recovery.	Based on a discussion with EPA, additional discussion concerning whether RAOs have been met based on guidance and existing site conditions will be incorporated into the revised RI as requested by EPA. In addition, the RI will include a discussion of the path forward. The path forward and RAO text will be drafted in consultation with EPA prior to submittal of the draft final. EPA will be responsible for making the final risk management decision and path forward decisions.
6. Data from the Portland Harbor Remedial Investigation indicate stormwater sediment contains DDT. This information would be a useful reference to put the presence of DDT in the Study Area in context.	Information regarding DDT concentrations in Portland-area stormwater catch basins has been added to Section 4.6.1 to provide context for DDT concentrations at the Study Area.
7. The Fish Consumption discussion relies too much on anecdotal references when the discussion could rely on the results of the Fish Survey conducted in Force Lake. Anecdotal information is valuable, but actual survey results are more objective.	Discussion was reviewed and revised to focus more on the results of the fish survey in the HHRA (fish consumption rates are not discussed in the RI).
8. Several sections of the report conclude that the volatile organic compounds (VOCs) in groundwater near the east margins of the Facility are migrating onto the Facility from upgradient sources. The conclusion is not supported by data because the RI does not provide upgradient (off Facility) groundwater data, the detected chemicals are similar to those on the Facility, and the RI does not identify potential upgradient sources. The RI should substantiate "upgradient" sources which are alleged to contribute to groundwater contamination. The statement should be revised and supported with facts.	Additional presentation of data and discussion have been added to support the conclusion that the VOCs identified near the northeastern margins of the Facility (GA-34 in the shallow zone and PW-01 in the deep zone) do not originate on the Facility. This information is summarized below.  Well GA-34 is located at the up-gradient margin of the Facility with regard to the shallow groundwater zone and is not located down-gradient of suspected constituent source areas at the Facility. Low-level and limited (year 2000 only) detections of vinyl chloride and cis-1,2-DCE at this location, in conjunction with the up-gradient position on the property, do not suggest an on-site or continuing off-site source for these VOCs. Similarly, low level benzene detections at this location (less than 3 µg/L) in conjunction with the position of this well being on the upgradient margin of the property, is not suggestive of an on-site source to this location. For the reasons cited, additional evaluation with regard to these one-time or low level detections is not deemed necessary.  As documented in GAI (1990), TCE and/or PCE have historically been identified in deep zone groundwater samples (Pleistocene gravels, generally greater than 100 feet bgs) collected from the Harbor Oil supply well, the Portland Stockyard production well, and from several other deep borings or wells in the area.  Further investigations related to TCE and PCE presence in deep groundwater were documented in GAI (1991). These additional



U.S. ENVIRONMENTAL PROTECTION AGENCY COMMENTS ON DRAFT REMEDIAL INVESTIGATION STUDY FOR THE HARBOR OIL SITE, APRIL 7, 2010  
VOLUNTARY GROUP RESPONSES – JULY 15, 2010

EPA Comment	Voluntary Group Response
	<p>investigations included a well survey with subsequent deep zone groundwater sample collection at supply wells W-5 (125 feet deep) and W-6 (86 feet deep) at the Heron Lakes Golf Course, and at a supply well of 166 feet depth located at the nearby Exposition Center property. Additionally, sampling results for the James River Corporation property well (No.2, 163 feet deep) were identified and reported.</p> <p>As summarized in GAI 1990 and GAI 1991, testing of groundwater samples collected from wells described above identified TCE and PCE concentrations within the deep groundwater zone that were relatively similar (generally between 1 and 20 µg/L). A table summarizing PCE and TCE results as available for area-wide deep zone wells, and a figure depicting the identified well locations are included within the revised RI report.</p> <p>As described in the RI report, no detectable concentrations of PCE or TCE have been identified within shallow or intermediate depth groundwater samples collected from the Harbor Oil Facility. Detections of PCE and TCE within shallow groundwater have been described at the Portland Stockyards property (GAI 1990).</p> <p>The area-wide nature of the PCE and TCE detections in deep groundwater in conjunction with the lack of such detections in the shallow or intermediate-depth groundwater zones at the Harbor Oil Facility provides sufficient documentation to conclude that the Harbor Oil Facility is not a contributing source of these constituents. The VG does not agree that it is the function of the RI or a responsibility of the VG to pinpoint the specific source for a deep area-wide chlorinated solvent plume when there is ample evidence to conclude that it is not sourced at the Harbor Oil Facility.</p>
9. The second page or continuing pages of the tables should have within the title "Continued" or "Page X of Y" to alert the reader to a multi-page table. See Section 4 for examples of multi-page tables needing title or page number revisions.	This formatting change has been made in the revised RI.
10. For simplicity, clarity and reduction of duplicative topics, the information for fate and transport (Sections 4.3.2, 4.4.2, 4.5.2, 4.6.2, 4.7.2, and 4.8.2) could be moved into Section 5.2.	The format of the draft RI (constituent-group specific vs. media specific) was selected in an effort to provide the best narrative for the reporting. Regardless of format selected, there would be some duplication of topics between sections. It is agreed that the consolidation of individual fate and transport subsections from Section 4 into a single subsection in Section 5 will add clarity and reduce redundancy. These changes have been incorporated into the revised document.
11. For simplicity, clarity and reducing some duplicative topics, the information and topics relating to exposures pathways and receptors in the first paragraph of Section 5.0 and Section 5.3 would best serve the report in Section 6. The diagram of Figure 6-1 covers the subject but narrative is needed in Section 6.	Additional narrative has been added to Section 6 using the information from Section 5.0 and 5.3.
12. Many figures don't include all sampling locations. For example: Figure 4-10 does not include SL-32, SL-45, or SL-46. But Figure 4-9 does include those locations. Please provide a note explaining why some locations are not depicted on a figure.	A complete QC of figures has been done to ensure that all samples locations are shown. If a location was not sampled for a given constituent, a footnote was added to that figure to clarify this.
<b>Specific Comments</b>	
1) Executive Summary and Section 1.1 – Identification of the objectives for the Remedial Investigation (RI) should be completed by stating that the objective is to support an informed risk management decision "regarding the remedy for the site." The RI provides information to support identification of remedial alternatives and for selecting a remedy (including a no further action alternative). This key component of the process is missing from the objective statement.	Text has been edited in the revised RI.
2) Executive Summary and Section 1.3 – Information should be provided regarding how the Site and Study Area were defined during the regulatory process. The description of the Study Area should provide the total size (acres) of which the 4.1-acre Facility is a subcomponent.	The use of the terms Site and Study Area have been clarified. Additionally, the size of the Study Area (19 acres) was added to the RI.
3) Executive Summary ES.2 – The bullet list of sample and/or location counts appears to be inconsistent with information presented in the RI (see Table 4-1). A presentation of either number of samples or number of locations is recommended. In addition, a count that is consistent with Table 4-1 should be considered. The 61 locations for Facility samples should indicate that the count includes stockpile and berm samples. The count of wetland soil samples could be interpreted as being 57 (47 plus 10), whereas Table 4-1 has 46 locations.	The discrepancies noted between the list in ES.2 and Table 4-1 have been corrected. To reduce future confusion, it has been clarified that these numbers represent a count of locations (not samples).
4) Executive Summary ES.3 – Brevity is good, but there could be slightly more information. For example, the "Meteorology" could include brief mention of mean precip and mean temperature. The "Hydrogeology" topic could include the basic depth to groundwater and less about the various vertical gradients and a discussion of groundwater discharge to Force Lake.	The balance between brevity and the amount of detail conveyed within an Executive Summary can prove challenging. EPA's desire for slightly more information, including the cited examples, is acceptable and the document has been revised accordingly.
5) Executive Summary ES.3 – Information presented in the last two bullets does not appear consistent for the Study Area. The predominant use of the Study Area appears to be recreation (surrounded by golf course) with public access, and managed as a wetland habit. The "Facility" is an industrial property, being only a portion of the Study Area. Land use, current and future for the Study Area, could be described as recreation, habitat, and wetlands, as well as industrial.	Text has been added to this section stating that the likely future land use of Force Lake and the wetlands is recreation and habitat for ecological receptors.



U.S. ENVIRONMENTAL PROTECTION AGENCY COMMENTS ON DRAFT REMEDIAL INVESTIGATION STUDY FOR THE HARBOR OIL SITE, APRIL 7, 2010  
VOLUNTARY GROUP RESPONSES – JULY 15, 2010

EPA Comment	Voluntary Group Response
<p>6) Executive Summary ES.4 Nature and Extent – The opening paragraph is too heavy on detail for Executive Summary and does not appear to follow with the remaining text. Suggested phrase is to state that specific analytes or analyte groups were selected for presentation based upon their association with past use of the Facility or for their contributions to human health risk and ecological effects. Key Findings should include mention of LNAPL and principle constituents which contribute risk.</p> <p>a) The summary Tables would be more informative of nature and extent if the frequency of detections and or number of detections per analyses were listed instead of the mean value. Because the RI concludes that the presence of LNAPL is isolated and very minor, the Executive Summary should mention its limited presence but not include analytical results in the table.</p> <p>b) The bullet list summary of key nature and extent points can be improved by reducing some detail and identifying analyte groups that matter most (total petroleum hydrocarbons [TPH], polycyclic aromatic hydrocarbons [PAH], polychlorinated biphenyls [PCB], pesticide), media (soil, sediment, surface water, groundwater) and with a consistent comparison to the criteria (RSL) or other screening values. The vicinity can be mentioned relative to the media. The third bullet is an example and could use mention of which analyte groups were detected.</p>	<p>Intro text: The opening paragraph of ES.4 has been removed per EPA comment.</p> <p>a. Detection frequencies (percentages) have been added to Tables ES-1 and ES-2 and presentation of LNAPL results has been removed from Table ES-2.</p> <p>b. Discussion of nature and extent was expanded to include more discussion of the analyte groups that matter most and to provide additional information regarding comparison to criteria.</p>
<p>7) Executive Summary ES.5 - The Conceptual Site Model (CSM) discussion should identify pathways and media for the Study Area. The summary bullets provided relate to the Facility and Facility soils with one mention of adjacent wetlands. Please include brief summary of migration potential to surface water, sediment, and groundwater. This section should include a brief discussion of future land use.</p>	<p>Section ES.5 has been revised as requested based on the changes to Section 5.</p>
<p>8) Executive Summary ES.6.1 Human Health Risk Assessment – The last part of the first paragraph could replace the “conservative” word and express the perspective that the scenarios used were selected to support the risk-based decision process by assuring that the risks are not underestimated.</p> <p>a) The Table ES-3 please clarify or revise the bolded phrase “Total risk across media” because this appears to present the cumulative risk per scenario.</p> <p>a) Present the hazard quotients as the actual value rather than &gt;1.</p> <p>b) The Table ES-4 may not be needed for an Executive Summary presentation. The most important executive summary type facts from Table ES-4 could be presented as a brief narrative immediately following Table ES-3. The summary could focus on the two exposure scenarios with risk in the 10<sup>-5</sup> range and the constituents that contribute greater than 30 percent to the risk. There does not appear to be a need to have a narrative summary for the child recreational scenario or the child fish consumption. However, that may remain. In addition, because the risks are within the risk management range, there is not a particular need, in the Executive Summary, to discuss the contribution from background or naturally occurring concentrations of arsenic.</p> <p>c) Please clarify the terminology “without identified sources” used in the last paragraph, and also in Sections 6.2.4, 7.1.6.1, and 7.1.6.2. The purpose of the RI is to identify the sources of COCs at a site.</p>	<p>a. Text changed to “cumulative risk across media.”</p> <p>a. Table ES-3 has been modified to show HIs when total HQs were greater than 1, as done in the HRHA.</p> <p>b. Table ES-4 has been deleted and a brief narrative has been added to discuss percent contribution to the total excess cancer risk and background/reference area risk estimates.</p> <p>c. This phrase was intended to clarify that the “reference area” concentrations for organic compounds were from locations not known to have specific sources areas (i.e., not industrial properties known to be polluted). However, the Voluntary Group agrees that this language could be confusing, and thus it was removed from the revise RI.</p>
<p>2) Executive Summary ES.7 This section can be reduced because many of the details should already be in previous ES sections, or are not required for executive summary level of information.</p>	<p>Section ES.7 has been shortened to remove some of the excess detail provided in earlier sections of the ES or detail that is not needed in an ES.</p>
<p>3) Executive Summary ES.7.1 – The risk conclusion for the results of screening for residential exposure should be presented in this section.</p>	<p>Details regarding the residential screening assessment have been added to the revised RI.</p>
<p>4) Executive Summary ES.7.2 The statements, “likely attributable to non-Facility-related sources” and “migrating onto the Facility from up-gradient sources” are not supported by the details of the RI and should not be part of the Executive Summary information.</p>	<p>As clarified in the response to general comment 8, the document has been revised to include additional details as needed to support these conclusions and as such these conclusions have not been removed from the document. Minor revisions to the related discussion in Section ES.7.2 have been included to provide clarity regarding the support for these conclusion statements.</p>
<p>5) Executive Summary ES 7.2 states that “it is suspected that well B-4 may have served as a conduit for the deeper migration of DDD from surrounding soils.” This hypothesis is repeated again in Sections 4.6.3.2, 5.2.1.1, 7.2.2, and Table 7-9. For example, Section 5.2.1.1 states that “one possible explanation for the presence of DDTs in intermediate and deep wells is that B-4 is an older well established prior to 1990 and may have served as a conduit for the deeper migration of DDTs from surrounding soils. However, the mobility of DDTs in soil is generally low.” EPA previously commented on this issue (Section 6.2.2 of the Draft Preliminary Site Characterization Report stated that the “presence of DDTs in the deep zone reflects a problem with the integrity of deep well B-4”). EPA’s comment was that “Adequate evidence is not presented to support this conclusion. Furthermore, if there is a problem with the integrity of well B-4, immediate action may be required to address the issue of potential cross contamination.” VG’s response was to confirm the results with isotope dilution methods during Phase 2. Now that the results have been confirmed, please address EPA’s previous comments. The RI inappropriately selects “one possible explanation”</p>	<p>The detailed response to EPA comments on this matter is provided as the response to specific comment 55 (related to Section 5.2.1.1). The EPA is correct that there is not adequate evidence to definitively conclude that the identified DDD concentrations in the intermediate and deep groundwater zones are the result of a well seal breach (note that the detections were below human health screening levels). However, neither is there adequate evidence to support a conclusion that the DDD has migrated to these depths via natural groundwater transport mechanisms. In fact, natural transport is deemed highly unlikely due to the extremely high retardation of DDD as described in response to Comment 55.</p> <p>The well seal breach hypothesis was developed based on a weight of evidence approach and vertical channeling through a breach in the well seal of B-4 is still felt to be the most likely mechanism leading to the presence of DDD at the adjacent MW-2i location and the B-4 location.</p>



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instead of verifying the explanation.	Based on the preceding information and as per a path forward suggested by the EPA – it is recommended that the owner of well B-4 decommission that well in accordance with the requirements of the State of Oregon. The proper decommissioning of this well will eliminate that borehole as a possible conduit for vertical migration. <i>ok</i>
6) LNAPL is identified in the wrong well, it should be GA-30.	Several sections of the Executive Summary erroneously identified well GA-34 as containing LNAPL. The EPA comment is correct in that well GA-30 should have instead been cited in order to be accurate and consistent with the body of the report. The report has been revised accordingly. <i>ok</i>
7) Executive Summary ES.7.4- Force Lake Sediment and Surface Water – The 7 <sup>th</sup> bullet discussion regarding the effects of total organic carbon (TOC) on the bioavailability of dichlorodiphenyltrichloroethane (DDT) is not clearly developed or quantified in the RI report and should not be presented in the Executive Summary. If the bioavailability is to be considered, the effect of TOC should be quantified and developed for both DDT and PCBs. Include a bioavailability discussion in the text.	A discussion of the effects of TOC on bioavailability has been added to Section 5. <i>ok</i>
8) Executive Summary ES.7.5 Remedial Action Objectives – Include the RAO's that were developed. The two bulleted RAOs listed in Section 7.3 should be presented and related to the current finding of the risk assessment. Conclusions can offer risk-based facts to identify if the current conditions are adequately protective and some RAOs met or what RAOs can be the focus of the next phase.	Text will be added. See response to general comment 5. <i>ok</i>
9) Figure 1-4 <i>Potential Off-Facility Sources</i> : Should include facilities and features discussed in text. Not all upgradient facilities (source of TCE in PW-01 for example) are included on the figure.	Figure 1-4 has been updated to expand the area shown such that the full extent of the properties described in the text are depicted. The locations for the deep area-wide sampling for chlorinated solvents that were conducted as part of the Portland Stockyard investigation are identified on Figure 3-4.
10) Figure 1-5 <i>Former Facility Features</i> . Needs to include utilities, former septic tanks, other underground piping, and location of the curtain drain piping. There should also be a figure depicting changes in Facility topography.	Available documents were reviewed and a representative of the current Facility operator (D. Coles) was contacted to identify all known subsurface utility locations at the Facility. The results of this additional research have been incorporated into Figure 1-5. Similarly, changes in Facility topography were researched and the findings have been added to the revised report. <i>ok</i>
11) Figure 1-6, and 1-7: Sampling locations EW-1, EW-2, and EW-3 are not shown on the figure, but are mentioned in text. Include them on the appropriate figure.	Wells EW-1 through EW-3 were not installed as groundwater monitoring wells and were therefore never sampled. Additionally, no soil samples were collected during the installation of these wells, and only trace levels of LNAPL have been identified (insufficient for sample collection) at any of these locations. Because Figures 1-6 and 1-7 depict surface water and soil sampling locations, the locations of EW-1 through EW-3 are not depicted on these Figures. Wells EW-1 through EW-3 are instead depicted on Figure 1-8 (pre-RI well locations) and 2-1 (pre- and post-RI well network). The text has been clarified so that references to appropriate figures are readily discernable. <i>ok</i>
12) 1.3.2 <i>Facility History</i> . There should be a discussion of activities associated with the installation of the extraction wells.	Clarification regarding the history and purpose of extraction wells EW-1 through EW-3 have been included in the revised RI document. Extraction wells EW-1 through EW-3 were installed by Coles Environmental, Inc. in 2003 coincident with the construction of the base-oil plant at the Facility. Based on a personal communication with Mr. David Coles on June 16, 2010 (Rob Ede to David Coles), extraction wells EW-1 through EW-3 were installed solely as a precautionary measure within three pits that were backfilled with angular gravels and cobbles that had been dug below the water table as part of foundation and electrical work conducted for the base oil plant construction.  Specifically, according to David Coles, these wells were installed within the existing pits out of recognition that pits filled with granular material within the oil plant area would make excellent LNAPL collection points and that it would be remiss not too plan ahead for the potential removal of any accumulated LNAPL. As such, there were never any specific plans to operate these wells.  As documented in the RI, wells EW-1 through EW-3 have not identified the presence of recoverable volumes of LNAPL, and for that reason they have never been used for recovery. The function of wells EW-1 through EW-3 remains entirely precautionary in nature. <i>ok</i>
13) 1.3.2 <i>Facility History</i> . Site history notes that Union Stockyard was a site owner and cattle truck washing was 90% of the washing business. Add a discussion about the use of DDT and other pesticides at the stockyards and evaluate this as a potential source for DDT present within the Study Area. Considering the drainage patterns in the earlier aerial photos, the distribution of DDT may be consistent with a source at the truck washing facility. DDT dusting/spraying of cattle and hogs should be evaluated and discussed in the RI.	A review of available documents at the DEQ Northwestern Region Office was conducted on June 16, 2010 in an effort to determine what, if any, testing for DDT or other pesticides has been conducted on the former Portland Union Stockyard property. The effort included a review of all files made available by DEQ for ECSI Sites 1091 (Portland Union Stockyard property) and 1505 (Peninsula Terminal Property). The Peninsula Terminal property is immediately south of the former stockyard pens and was used for loading and unloading livestock.  Although conventional wisdom of practices at the time would suggest that DDT may have been used for pest control and as a cattle or hog dip or spray at the Portland Stockyards property, <u>no documentation confirming disproving DDT use was identified.</u> Although speculative, it is reasonable to conclude that DDT may have been used at the Portland Union Stockyards property as <i>?</i>



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	<p>suggested by EPA. Similarly, if present in residues on cattle trucks, then DDT could have been distributed at the Harbor Oil property as a function of the trailer cleaning operation. Therefore, EPA is correct that the distribution of DDT concentrations in soil in vicinity of the former truck wash, in conjunction with the historical site topography/drainage, is suggestive that rinsate from the former truck wash may have entrained DDT residuals, as was described in the draft RI report.</p> <p>Additional discussion regarding the preceding issue has been included in the revised report. The VG Group would like to stress that although a specific source for the DDT may not be unequivocally presented in the RI, the nature and distribution of the DDT has been presented and sufficient evaluation and study have been completed to demonstrate the lack of an on-going release of DDT to Facility soils and to describe the nature and extent of DDT concentrations.</p>
<p>14) 1.3.2 <i>Facility History</i>. There should be some discussion if leak testing has been done on the pipes or tanks and the results of those tests. The presence of gasoline in soils may indicate relatively current releases are occurring.</p>	<p>According to David Coles, Coles Environmental Consulting, Inc., tightness testing of tanks and piping has not been completed by EMRI. The text within Section 1.3.1.2 has been updated as such. As depicted on Figures 4-4 and 4-10, in relation to known location of underground petroleum piping, the greatest gasoline-range hydrocarbon concentrations were identified in shallow soils proximate to this underground product line. The presence of these shallow impacts could be a function of a release associated with the piping in this area. This information will also be noted in the discussion concerning distribution of benzene/gasoline in soil found in Section 4.</p>
<p>15) 1.3.2.7.5 <i>New Base-Oil Refining Plant Construction</i>. Should include a discussion of impacted soil and field observations encountered during these excavation activities.</p>	<p>Discussion of field observations of impacted soils encountered during the 2003 Base-Oil Refining Plant construction activities has been incorporated into Section 1.3.2.7.5 of the revised RI Report. A summary of this additional information is provided below.</p> <p>Mr. David Coles of Coles Environmental, who oversaw the soil excavation and stockpiling of soils during construction of the base-oil plant construction, indicated during a June 16, 2010 telephone conversation with Mr. Rob Ede of Hahn and Associates, Inc. that there was no formal write-up of observations made during the 2003 base-oil plant construction-related excavation activities. Review of historical documents that describe or summarize historical activities at the Facility were completed and no information concerning field observations of impacts were identified, although analytical testing in the base oil plant area was conducted prior to construction as is described in Section 1.3.3.4 of the revised RI report.</p> <p>Mr. Coles provided a general description during the above-referenced telephone conversation of the types and magnitude of visually impacted soils as were made during the base-oil plant construction-related excavation work. Mr. Coles indicated that evidence of oil was apparent in soils as they were excavated, with zones of “clean” (e.g., minor or lack of visual indications of impact) soils mixed with zones or layers/lenses of soil that varied from dark staining and a petroleum odor to discontinuous zones (lenses or layers) of soils that had visual evidence of oil product. He cited that these oily layers or lenses might typically be on the order of one inch thick by several feet in length and were not continuous (e.g., patchy) over the area of excavation.</p>
<p>16) 1.3.3.4 2003 <i>CEC Soil Sampling</i>. Although the data did not meet DQOs, the analyzed constituents and their concentrations should be discussed.</p>	<p>As requested by EPA, the results of the 2003 CEC Soil Sampling activities have been discussed in a revision of Section 1.3.3.4.</p>
<p>17) Figure 1-9: Describe the effect and purpose of the Pump Station in the text. Is it to control Groundwater elevations? A sewage pump station? Can it effect groundwater flow within the Study Area? Etc..</p>	<p>There are two “pumping stations” noted on Figure 1-9, both of which pump surface water runoff from one side of a dike or levee to another side of a dike or levee. Based on what is known regarding the function of these pumping stations, neither pumping station is expected to influence the groundwater flow regime in the Study Area. At the EPA’s request, the text of the RI has been revised to identify and describe each of these pumping stations, referencing Figure 1-9. Included in the revised text is a description of potential influence to the groundwater flow regime within the Study Area (none are expected).</p>
<p>18) Section 2.0 – top of page 53. The bullet list presents the study objectives and not the RAOs. Please revise.</p> <ol style="list-style-type: none"> <li>The second item in bullet list at bottom of page 53 refers to “Facility-related chemicals.” The definition of this phrase is not provided. The text should be revised to define this phrase (e.g., specific chemicals) and distinguish this phrase from the phrase, chemicals of concern (COC).</li> <li>The last item in the bullet list at bottom of page 53 refers to evaluating chemicals of concern (COCs) in the risk process. However, the COCs are the outcome of the risk evaluation. Please revise. Perhaps this reference should be made to evaluating chemicals of potential concern.</li> </ol>	<p>These changes have been made in the revised RI. Also see response to general comment 2.</p>
<p>19) Section 2.3.1.3 <i>Water Level and Free Product Measurements</i>. Note that the water level was often above the screen interval. Discuss the impact this would have on determining the presence of LNAPL in a well. The product was described as “viscous oil (black &amp; thick)”. Discuss the LNAPL characteristics relative to migration potential and ability to impact groundwater. A lack of LNAPL in the well may not be an appropriate indicator of a lack of LNAPL in the subsurface. Discuss surrounding borings and groundwater monitoring results downgradient of the LNAPL.</p>	<p>Discussion concerning the nature and extent of LNAPL is provided in significant detail in the RI Report, including a description of surrounding borings and groundwater quality data down-gradient of locations with known LNAPL. Additional discussion concerning limitations concerning the LNAPL evaluation due to screen placements has been clearly discussed in the revised text of Section 2.3.1.3. Similarly, Section 2.3.1.3 and related subsections in Section 4 have been updated as requested by EPA to describe the LNAPL (viscous oil-black and thick), and to include a description of the review of soil screening results for surrounding borings. The additional evaluation and the review of boring logs confirms the finding of limited LNAPL</p>



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	extent/mobility at the Facility.
20) Section 2.7.2 – Force Lake Fish Survey – The first paragraph reference to additional information in Appendix H should briefly explain what the appendix presents and if the information is “additional” as information other than what is summarized in the section, or if the appendix information is supporting details that are summarized in the section. Footnote 5 on page 83 is information that should be presented in the text of this section.	Text has been added to clarify the information provided in Appendix H. Footnote 5 on page 83 has been incorporated into the text of the report.
<p>21) Section 2.8.2 – Total DDTs</p> <p>a. The second bullet states that certain values were not selected in an effort to be “conservative.” Please expand the information to identify the objective for selecting values. The discussion should also identify how the analytical results that were selected are considered representative of ambient conditions.</p> <p>b. The values for the low end of the range in Table 2-9, as indicated by footnote, are one-half the reporting limit. The actual reporting limit should be presented without manipulation. For Table 2-10 the discussion should clearly identify if the values have been manipulated/adjusted and the “nd” should be replaced with less than the method reporting limit value.</p> <p>c. As properly stated in the discussion of DDT, the concentrations from the literature search are values that represent a range of possible DDT concentrations in sediment and soil. Concentration values with a similar range of values might be expected within the Study Area. These are “reference” values and not actual background values. The RI should be revised to consistently refer to reference values and not “background” values. Note that the “background” terminology is also used in Attachment 7 of the Draft Final Baseline Human Health Risk Assessment and Attachment 4 of the Draft Final Baseline Ecological Risk Assessment, this should also be changed to “reference values”.</p> <p>d. The comments above apply to Section 2.8.3 – PAHs and 2.8.4 – PCBs and to Table 2-11. Please clarify how the values were selected and please refer to them with a term other than “background.” Use of a phrase such as reference values representing ambient conditions or literature values may be more appropriate.</p>	<p>a. Text was added in the revised RI to indicate the objective for selecting values for reference concentrations.</p> <p>b. The full reporting limits are shown in the revised RI. The full reporting limit values are reported in Table 2-10 and the footnote has been revised. The “nd” in Table 2-10 indicates when reporting limits were not provided in the source documents. This clarification has been added to the revised RI.</p> <p>c. Throughout the RI, HHRA, and ERA, the term “background” has been changed to “reference area” for organic constituents. For metals, the term “background” was retained because specific regional background values have been established.</p> <p>d. Consistent revisions have also been made in Sections 2.8.3 and 2.8.4, and throughout the rest of the RI and risk assessments.</p>
22) Section 3.3.2, p. 91, 2 <sup>nd</sup> to last Par.: Conclusion that pollutants from runoff would stay in Force Lake is too broad and unsupported. Dissolved phase pollutants would discharge via the culverts.	The text referred to in the comment has been updated to include the additional information to support the City of Portland’s conclusion in the Natural Resource Management Plan for Pen 1 regarding the limited transport of constituents to North Lake from Force Lake. Findings from the RI are referenced to indicate that only very limited transport appears to have occurred based on generally low concentrations of constituents in North Lake sediments and on the limited detections in Force Lake surface water (i.e., that dissolved phase constituents are not a major issue).
23) 3.4.2 <i>Local Geology</i> . Foundry sand is noted as being present from 0 to 3 feet. Include and discuss this as a potential source of metals and potential for leaching to groundwater with discharge to surface water. Please include where foundry sand was encountered, as it is not included on the logs.	<p>Research into the origin of “foundry sand” within the text descriptor for the fill soils at the Facility was conducted by the VG in response to this inquiry from the EPA. Background documents as referenced in the RI report were reviewed for reference to “foundry sand” to determine if there was a historical, known source of fill to the property that would include such sand. No such reference was found. In interviewing field personnel who conducted much of the RI field work on the Facility, one individual noted certain observations of blackened soils as “foundry sand” in some of the field records. The individual did not have knowledge of there being “foundry sand” on the property, and used this term as a descriptor. According to a conversation with David Coles on June 16, 2010, Mr. Coles is unaware of any information or observations relative to the Harbor Oil Facility property that would suggest the presence of foundry sand.</p> <p>Based on the preceding research and the conclusion that there is no basis for the presence of foundry sand on the property, the noted reference has been removed/corrected from the sections in the RI Report where it was previously noted.</p>
24) Section 3.5.2 <i>Local Hydrogeology</i> –Perhaps the information being presented in the first bullet is an elevation range above mean sea level. See Table 2-2 and revise to be consistent. The shallow depth of ground water should be presented in other sections, including, but not limited to the Executive Summary.	The information presented in the report often refers to the depth to the base of the shallow water-bearing zone, where elsewhere the depth to the water table is discussed. In order to avoid the confusion this has caused, the text has been revised to clearly refer to the depth/shallow nature of groundwater beneath the site and where depth to the base of this zone is described, it has clearly been referred to as such.
<p>25) Figures 3-1 and 3-2: include the seasonal groundwater elevations and Force Lake on the figures.</p> <p>26) 3.5.2 <i>Local Hydrogeology</i>. Include a discussion of the relationship between groundwater and surface water (Force Lake and North Lake).</p>	The referenced figures have been revised to depict seasonal low and high groundwater elevations as well as the elevation for Force Lake. Because Figure 3-2 does not include Force Lake, a new cross-section has been prepared that extends to Force Lake so that the relationship groundwater and the surface water in the Lake (shallow groundwater discharge to the Lake) may be better represented.
27) Section 3.5.2.3.2 <i>Aquifer Pumping Test</i> – Please include in this section a brief explanation regarding the inadequacy of the monitoring wells for an aquifer test. Is this related to potential yield, or screen interval or completion depth? In addition, the last paragraph refers to complications from tidal effects in the deep (210 feet bgs) zone. Please explain what is the source of these	Additional explanation has been incorporated into the revised document.



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effects and if the water level in the “slough” and nearby Columbia have variations in water level, from tides, that could affect an aquifer at that depth.	
28) Section 3.6.3 Future Land Uses - This section should clearly state that a potential future land use for the Study Area is a wetlands habitat and recreation area consistent with the information presented in other parts of Section 3.6 and section 3.7.1. Please refer to Specific Comment 5.	The clarification regarding potential future land use within the Study area has been incorporated into the revised document.
29) <i>Table 4.1.</i> Please include LNAPL	LNAPL has been added to Table 4-1 and a discussion of the 2000 LNAPL sample has been added throughout the RI where the 2008 LNAPL sample was discussed.
30) <i>Figure 4-9:</i> Sampling locations SL-36 and SL-28 appear to be switched. Check all figures for accuracy.	A full QC of figures has been completed. See response to general comment 12.
31) <i>Figure 4-11.</i> Include all well locations (extraction wells and wells with LNAPL). Note those wells not sampled due to the presence of LNAPL. Ideally a figure, or inclusion of the extent of LNAPL present could be inserted on figure 4-11.	Figure 4-11 and all other figures that provide groundwater quality data at the Facility have been revised to depict all well locations at the Harbor Oil Facility. A symbol has been added to depict those well locations where LNAPL was present, or has previously been identified (GA-30, EW-1, EW-3). An indication of the magnitude of LNAPL identified is also included (trace to 0.02 feet). Also, a footnote has been added to note which well locations were not sampled as part of the RI and why.
32) <i>Table 4-2:</i> The Table indicates the LNAPL sample depth was 14 feet bgs, this is inaccurate and misleading. The well may extend to 14 feet bgs, but the text and logs indicate the LNAPL is on the surface of the groundwater. Include a table with the analytes evaluated and their respective results for the LNAPL monitoring.	The document has been revised to note that the LNAPL sample was collected from a depth of 2.58 to 2.68 feet bgs.
33) Section 4.1.3.1, Groundwater RSL's: Safe Drinking Water Act Maximum Contaminant Levels should be included.	EPA MCLs and non-zero MCLGs were used in the RI, but were unintentionally omitted from discussion in Section 4.1.3.1. Discussion has been added to the revised RI.
34) Sections 4.2.1 and 4.2.3.2, Discussion of DDT application: Provide substantiation and verification of the DDT application at Vanport. Who (City, State, Federal, Private) specifically directed the spraying, how much was applied, what was the dosage, etc...	Additional information regarding DDT application at Vanport City has been added to the revised RI (application was done by the Housing Authority of Portland, likely a 5 to 10% DDT solution), along with general information regarding historical DDT uses.
35) Section 4.3 – First paragraph, last sentence the information summarizing conclusions of the risk assessment can be deleted as it is not relevant to the discussion.	Text has been revised as suggested.
36) Section 4.3 – Last paragraph; the section could benefit from a summary narrative of methods used to determine the benzo(a)pyrene (BaP) equivalent values for the carcinogenic polyaromatic hydrocarbon (cPAH) compounds. Summary should include the source and reference for the equivalent factors and how the individual analytical results and the values less than reporting limits were processed in the calculations.	The method for calculating the cPAH TEQ has been clarified and a citation has been added to the revised RI.
<p>37) Section 4.3.2 - Constituent Fate and Transport. The five short paragraphs comprising less than a page of information for this section is too brief and does not present the information needed to support the conclusions in other sections of the report.</p> <ul style="list-style-type: none"> <li>a. The fate and transport discussions in Sections 4.3.2, 4.4.2, 4.5.2, 4.6.2, and 4.7.2 could be moved to a more detailed discussion of fate and transport specific to the Study Area chemicals discussed in Section 5.2.</li> <li>b. There does not appear to be a section that provides a quantitative explanation of properties such as the “high affinity for organic matter.” The chemical characteristic factors (e.g., partitioning coefficients) such as those used in Section 5.2 (for dichlorodiphenyldichloroethane [DDD]) should be identified and tabulated for the site-specific chemicals identified in the fate and transport section of the report.</li> <li>c. The fate and transport discussion should provide a table of the chemical properties, factors, partitioning coefficients, and the site-specific data, such as total organic carbon (TOC) concentrations in soil that are used in Section 5.2. Several sections (6.2.4, 7.1.6.2, 7.2.4, and the Executive Summary) make statement regarding the effect of TOC on the fate and transport of organic chemicals. There is a reference in Section 7.2.4 to a mean value of TOC as 7.1 percent for sediment and in Section 5.2.1.2 to an average TOC of 4.8 percent for subsurface soil. However, there does not appear to be a discussion of the TOC data nor is there a section that quantifies the effects of TOC for DDT in sediment.</li> <li>d. Section 4.3.2 - The third paragraph does not identify which chemicals are being referred to as “non-polar compounds” and should discuss chemicals specific to the Study Area. The fate and transport discussion could benefit from a discussion of other properties such as the tendency for chemicals to bioaccumulate and those chemicals that may be metabolized by organisms and not bioaccumulate. Although there are subsections for the specific chemicals, those subsections do not provide chemical properties to support conclusions in subsequent sections of the report. Other chemical-specific fate and transport discussions, such as Section 4.4.2 for PCBs, and Section 4.6.2 for DDT both refer to Section 4.3.2 as providing the detailed information to support characteristics of fate and transport. Recommend that the fate and transport discussion be put</li> </ul>	The requested restructuring of the RI Report has been completed. A table providing a summary of the common fate and transport chemical characteristic factors for site-specific chemicals has been incorporated into the revised text. Additionally, subsections have been added to Section 5 that discuss bioaccumulation potential, bioavailability (including the influence of TOC for non-polar organic compounds), degradation processes, volatility, and solubility. This information was provided to provide the reader with a better understanding of the fate and transport of these constituents, which in turn better supports the CSM.



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in Section 5.2 and the properties presented in a new table in Section 5.	
38) Section 4.3.3.1 references Table 4-4 for chemicals in soil. The correct reference may actually be Table 4-3. Globally check all table and figure call outs with the actual table location and title.	Table reference has been corrected. A full QC of table and figure callouts was conducted.
39) 4.3.3.3 LNAPL 3 <sup>rd</sup> Paragraph: The text states that: "Most constituents discussed in this section were not detected" in referring to LNAPL sampling. Reconcile this with information in Table ES-2 that indicates TPH, PAHs, cPAHs and PCBs were detected in the LNAPL. Also pesticides were detected in 2000 sample. Provide more detail of the actual COPC's detected in the LNAPL versus a general statement which provides minimal value to describing the characteristics of the LNAPL.	The sentence identified by EPA has been stricken from the document since the description of the testing results stands for itself. Additional discussion has been added to this section of the report, as well as to Sections 4.4, 4.5, 4.6, 4.7, and 4.8 describing the 2000 LNAPL sampling results, which were for select pesticides and PCBs only.
40) 4.3.3.3 LNAPL. Include a complete discussion of LNAPL analysis that met DQOs (2000 E&E and current).	See response to specific comment 39. The requested discussion concerning the 2000 LNAPL analysis has been incorporated into appropriate sections of the report.
41) 4.3.3.3 LNAPL. States "did not identify LNAPL at any boring location." Field notes indicate that field screening of sample SL-10-6-18 include "product". Please rectify this discrepancy.	The discrepancy in the text has been corrected and described in the revised report. The finding that LNAPL is only present at limited portions of the Facility and delineated by adjacent borings remains unchanged.
42) 4.4.4 PCB. The summary should describe PCBs and concentrations that were detected in LNAPL.	A description of the results of the PCB sampling of the LNAPL sample has been included in Section 4.4.4 of the revised document.
43) Section 4.8.3.2 mentions plant well B-4. The well referred to is likely PW-01. Check to ensure references are accurate.	The text of the report has been revised to correct this typographical error.
44) Provide a figure showing all groundwater monitoring wells used for characterizing groundwater at the site.	Rather than showing all sampling locations on Figure 2-1, this figure was split into two. The first figure shows soil/sediment locations and the second figure shows groundwater/surface water locations.
45) Section 4, Figures 4-29 through 4-33, 4-36, and 4-39, the screening levels in the legend for surface water are "not detected;" this should likely be changed to "not available."	"Not detected" is noted in the screening level table in these figures because these constituents were not detected in surface water. Thus, no comparison to criteria was needed. The figures were revised to make this more clear.
46) 4.5.1 and 4.6.1 <i>Known or Suspected Sources and Release Mechanisms</i> . Foundry sand is noted as present at the site in section 3.4.2. Discuss if this is a potential source of metals. These sections make similar statements that agricultural applications that involved the use of some metals (arsenic and copper) and DDT could also account for their presence at the Facility as a result of cattle truck cleaning operations. Discuss this in relation to the fact that Union Stockyard was a historical site owner (Section 1.3.2.4.3 Canal Capital Corp aka Union Stockyards Corp.) and with respect to constituents detected at the Stockyard. This may require additional discussion in section 1.3.3.1 1990 Stockyards Site Investigation.	As described in response to specific comment 23, foundry sands have not been identified, nor are they suspected to be present, at the Harbor Oil Facility. Applicable portions of the report have been revised to correct this error. Therefore, no changes to Section 4.5.1 are necessary to identify foundry sands as a potential contaminant source.  With regard to DDT and the Portland Union Stockyards, the response to specific comment 13 clarifies the additional research identified. Sections 1.3.3.1 was revised to describe these additional research findings and Section 4.6.1 was similarly revised.
47) Section 4.6.4: Inadequate discussion on source of DDT/DDD/DDE in wetland and Force Lake. What does the statement that there is no definitive source data available mean? The purpose of the RI is to determine whether a source exists for the contaminants. The text should discuss whether concentrations are indicative of a spill of product or application for pest control. Elaborate upon this statement and whether the RI data supports the CSM. Also, please distinguish the terms "percent DDT vs total DDT".	The discussion of the source of DDD/DDE/DDT at the Study Area has been expanded in Section 4.6 to include possible routes for DDT to enter the environment and expected residual concentrations. This section also includes more discussion regarding what conclusion can be drawn from the known information.
48) 4.7.3.3 LNAPL. Text should be phrased more clearly. Were other chlorinated solvents detected that were not discussed in this section. A review of Appendix B (data tables) and Appendix C (Chain of Custodies) could not identify a location where LNAPL analysis was indicated. A search on "GA-30" did not result in any finds. Please indicate where the results of the LNAPL analysis are contained and present them in the text of the RI.	Text in Section 4.7.3.3 has been clarified.  EPA is correct that the LNAPL data table for Appendix B was inadvertently omitted. It has been added in the revised RI. Appendix C contains information regarding the 2008 LNAPL sample, but it should be noted that because the forms in this appendix are from the field, they are handwritten and thus the PDF is not searchable. The following are a few examples of where the LNAPL sample is referenced: page 45 (well development log), pages 169-170 (field notes from May 16, 2008 when sample was collected), and page 272 (COC).
49) 4.8.3.2 Groundwater. The presence of significant concentrations of dissolved iron in the shallow aquifer requires further discussion. An explanation for the low oxygen in the subsurface has not been offered. This may be a natural occurrence or related to elevated organics (contaminants) in the subsurface which are being degraded by microorganisms or some other geochemical process occurring. The RI needs to explain these results.	Discussion concerning the high concentrations of dissolved iron and low dissolved oxygen content of the shallow groundwater zone has been incorporated into Section 4.8.3.2 of the revised report. This information is summarized below.  Concentrations of dissolved iron have been identified in shallow groundwater beneath the Facility at concentrations typically between 20,000 µg/L and 65,700 µg/L. The extent to which iron dissolves in groundwater is primarily a function of the amount of oxygen in the water as well as the general iron content of the materials that comprise the matrix of the water-bearing zone. When levels of dissolved oxygen are low (e.g., less than 1 mg/L), iron has a tendency to occur as Fe <sup>2+</sup> , which will dissolve in water much more readily than the form of iron that is typically present in zones of higher oxygen content (iron oxides).  Dissolved oxygen levels in the shallow, intermediate, and deep groundwater zones, as recorded on groundwater sampling



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	<p>records, were typically less than 0.5 mg/L. Low dissolved oxygen levels are not unusual in groundwater due to a lack of atmospheric mixing and the degradation of organic matter, which could be present as natural organic matter, petroleum, coal, sawdust, plant matter, woody debris, etc. The dissolved oxygen levels in groundwater at the Facility are typical based on experience in the region and do not suggest a unique condition to the Facility.</p> <p>As reported in Table 4-23 of the RI report, total iron concentrations of soil samples collected from within the uppermost groundwater zone were found to have concentrations ranging from 200,000 µg/kg to 280,000 µg/kg, which given the low dissolved oxygen levels, would appear to support and explain the dissolved iron concentrations (20,000 µg/L to 65,700 µg/L) detected in this zone.</p>
<p>50) Section 5.0 Conceptual Site Model: Section is too general and does not provide any specific sources for the contaminants found at the site.</p> <p>a. The bullets in the opening paragraph are specific to the risk assessment process and are best reported in Section 6.1.2 and correlated with Figure 6-1.</p> <p>b. The last paragraph identifies subsections that are not consistent with the body of the report. Please check these and throughout the report for similar inconsistent section identification.</p> <p>c. Section 5.1 fails to provide specific sources for the COPC/COC's at the site, but only general activities. This is insufficient. The CSM should have been verified by the data collection and interpretation of results. There is no mention of the source of PCB's, pesticides or metals in this section, these should be addressed.</p>	<p>Section 5.1 (Sources and Release Mechanisms) has been revised to clearly summarize known or suspected sources of constituents identified in the Study Area based on the identified nature and extent of the constituents within the Study Area as well as the known history of activities within the Study Area and surrounding properties. Discussion concerning all constituent groups, including PCBs, DDT, and metals, were specifically addressed in the revised Section 5.1.</p> <p>EPA's suggestion to move bullets in the opening paragraph of Section 5 to Section 6 (Risk Assessment) is understood and appreciated, but these bullets set the stage for the discussion in Section 5.1 and 5.2 and provide linkage to Section 6. For these reasons, the opening paragraph of Section 5 has remained unchanged.</p> <p>A thorough check of referenced subsections within the report has been conducted to ensure that correct and consistent section references are made in the report.</p>
<p>51) Section 5.1 and 5.2 present the release and transport discussion that is typically presented in a "Fate and Transport" section. Section 5 could easily be re-titled "Fate and Transport" and include a subsection (5.1) for the conceptual site model discussion. As mentioned in previous comments to Section 4.3, the chemical properties and "fate" discussion can be combined and presented in Section 5.2.</p>	<p>As per EPA comments on Section 4.3 (see response to specific comment 37), the chemical properties discussion in Section 5.2 has been enhanced and individual discussions of chemical fate and transport as previously included as subsections to Section 4 have been combined into Section 5.2. The name of Section 5 remains "Conceptual Site Model," but Section 5.2 has been renamed "Fate and Transport" to more appropriately describe the function of that subsection.</p>
<p>52) 5.2 <i>Pathways of Migration and Exposure</i>. Preferential pathways from historic site features should be discussed. With regard to wetlands, surface water, and lake sediment an expanded discussion focusing on natural drainages prior to fill and golf course development would be beneficial.</p>	<p>An evaluation of potential preferential pathways of constituent migration from historic site features has been added to the revised RI Report.</p>
<p>53) Section 5.2.1 Groundwater Migration – The depth to groundwater values indicated for the shallow zone (8-15 ft bgs) are inconsistent with measurements reported in Table 2-2 (1-5 ft bgs; 8-15 ft AMSL).</p>	<p>The information presented in the report often refers to the depth to the base of the shallow water-bearing zone, where elsewhere the depth to the water table is discussed. In order to avoid the confusion this has caused, the text has been revised to clearly refer to the depth/shallow nature of groundwater beneath the site and where depth to the base of this zone is described, it has been <u>clearly</u> referred to as such.</p>
<p>54) 5.2.1 <i>Groundwater Migration</i>. Include a discussion on whether groundwater is discharging to surface water. The section does not indicate groundwater recharges Force Lake, just that it migrates toward Force Lake. Again, the RI is meant to verify the CSM for the Site and should definitively answer these basic issues.</p>	<p>Section 5.2.1 and other applicable Sections of the report have been revised to clearly indicate that shallow groundwater is <u>expected</u> to discharge to Force Lake. New figures and a cross-section have been developed (see response to specific comments 25 and 26) to support this finding.</p>
<p>55) Section 5.2.1.1: The explanation for the presence of DDD in B-4, 2i and 2s is inadequate. There may be other explanations, such as DDD is present in groundwater due to being dissolved in a carrier solvent. Also, the explanation that B-4 is an older well does not address the presence of DDD in 2i and 2s, which are new.</p>	<p>As reported in the RI, total DDT (specifically 2,4-DDD + 4,4-DDD at this location) has been detected in the shallow, intermediate, and deep groundwater zones at the MW-2s/MW-2i/B-4 well cluster location. Total DDT was identified at this location in shallow groundwater at a concentration 0.126 µg/L (total) and 0.073 µg/L (dissolved); in intermediate groundwater at a concentration of 0.015 µg/L (total) and 0.017 µg/L (dissolved); and in deep groundwater at a concentration of 0.012 µg/L (total) and 0.011 µg/L (dissolved). The identified concentrations in all zones were below the lowest human health screening level (0.20 µg/L). EPA conjectures that the presence of DDD at these depths might be a result of dissolution in a carrier solvent. A review of data indicates that gasoline-, diesel-, and oil-range petroleum hydrocarbons (hydrocarbon range of typical carrier solvents) have not been detected in groundwater at the MW-2i or the B-4 well locations and therefore this hypothesis does not seem likely.</p> <p>Calculations were presented that demonstrated that transport in the shallow groundwater zone to Force Lake, where shallow groundwater discharge occurs, would require approximately 140,000 years (14,000x retardation factor), by which time complete degradation would have occurred. Using the same retardation factor for potential vertical transport, and using estimated vertical advective velocities between shallow and intermediate and intermediate and deep zones, a DDD migration time between MW-2s and B-4 of approximately 450,000 years was estimated.</p> <p>The MW-2s/MW-2i/B-4 location was drilled through an area of deep DDT impacted soils as identified at 14 to 15 feet bgs in the boring for MW-2S. The construction of well B-4 is in question. The presence of DDT detections at MW-2i (38 to 48 feet bgs) and B-4 (85 to 95 feet bgs) do not correlate with the attenuation calculations as described above. The most likely explanation is that the well seal for well B-4 was breached allowing groundwater from the shallow zone to circumvent the native soils and</p>

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	<p>migrate vertically through the well casing or other potential voids into the intermediate and deep groundwater zones at this location.</p> <p>The preceding is a hypothesis based on observations and known conditions at the Facility and cannot be proven or disproven with available data. Although EPA suggests the occurrence of a breach is significant and suggests the need for immediate action, the concentrations (below human health screening levels) suggested there was time for the 2009 confirmation sampling without resulting in endangerment to human health or the environment.</p> <p>It is recommended that the owner of well B-4 decommission that well in accordance with the requirements of the State of Oregon. The proper decommissioning of this well will eliminate that borehole as a possible conduit for vertical migration.</p>
56) Section 5.2.1.2, Lateral Migration within the shallow groundwater: Include the calculated period of time, in years, it would take DDT and it's metabolites to migrate through soil to Force Lake.	The text has been revised to include the calculated time for DDD and DDT to migrate the distance between the down-gradient property line and Force Lake. For DDD the calculated migration time is 140,000 years, while similar calculations for DDT resulted in a calculated migration time of approximately 700,000 years.
57) Section 5.2: Please include a brief discussion of the potential for migration of chemicals through the food web. The Study Area chemicals compounds include bioaccumulative organics such as PCBs, and pesticides, and inorganics. The discussion can also identify other chemicals such as petroleum hydrocarbons and PAHs that typically are metabolized and do not bioaccumulate.	A discussion of the movement of constituents through the food web (i.e., bioaccumulation potential) has been added to Section 5. Also see response to specific comment 37.
58) 5.2.2 <i>Non-Aqueous Phase Liquid Migration</i> . Reconcile the statement that "LNAPL is not significant at the Facility" with the concern it was present at the site since 2000, and appears to have justified the installation of three extraction wells. Discuss whether product was ever removed from the extraction wells since their installation.	Section 5.2.2 and related portions of the RI report have been revised to describe the fact that LNAPL was first sampled (and therefore identified) in 2000 at well GA-30. At the time of sampling activities in 2008, well GA-30 remained the only well at the Facility with sufficient LNAPL for sample collection. Additional discussion of the rationale for the 2003 LNAPL extraction well installations (precautionary in nature and never used) was also included in the revised RI text.
59) Section 5.2.4, Figure 1-9: The text references a catch basin by N. Victory St. Please include the catch basin on Figure 1-9.	Figure 1-9 has been revised and a reference to this figure has been added to Section 5.2.4.
60) Section 5.2.4, p. 306, 2 <sup>nd</sup> Paragraph: Why the distinction in mentioning "filtered surface water"? Please explain the significance in the text.	The text has been revised to clarify that the filtered water samples are representative of the dissolved phase, thereby clarifying the function of this statement in the context of the overall discussion.
61) Section 5.3, Potential Receptors: At this point the RI should identify the known receptors. This section should be elaborated upon to provide details of known receptors and potential, ie: future, receptors. Issues related to the risk are best reported in Section 6.	Section 5.3 was deleted, and this information was incorporated into Section 6.
62) Section 7 Summary and Conclusions – Previous comments, particularly those for the Executive Summary, are applicable to Section 7.	Changes to other sections of the RI have been carried through to Section 7.
63) 7.1.2 <i>Study Area Investigation</i> . Include what phase of work LNAPL sampling occurred.	Section 7.1.2 was revised to specify that the LNAPL sampling (well GS-30) occurred during the Phase I RI sampling activities in April and May 2008.
64) 7.1.3 <i>Physical Characteristic of the Study Area</i> . Surface features - Include historical topography/surface features. Hydrogeology – include groundwater/surface water interaction.	Section 7.1.3 has been revised to be consistent with earlier responses to EPA comments concerning historical surface features and groundwater/surface water interaction.
65) 7.1.4 <i>Nature and Extent of Contamination</i> . Include a discussion of LNAPL and LNAPL constituents. A discussion about the nature, extent and source of DDT should be presented.	See response to general comment 4. Discussion of LNAPL and DDT sources has been added.
66) Section 7.1.5, 1 <sup>st</sup> Par. After 2 <sup>nd</sup> Bullet: This is a broad and unsupported conclusion of how contaminants migrated. Although storm water runoff is a component of the transport of contaminants, it does not explain the presence of contaminants at depth on the site and within the wetlands. Revise these statements to address the presence of contaminants at depth in Facility soils and Wetland soils.	This text has been revised to provide more information regarding the presence of constituents at depth in Facility and wetland soil. Sumps and holding ponds known to be located along the southwest Facility boundary likely collected wastewater and runoff. These areas were later filled as the Facility was developed.
67) Section 7.3 Evaluation of Preliminary Remedial Action Objectives (RAOs) - CERCLA identifies the RAOs as providing the chemical specific, media specific, and pathway specific objectives for the remedial action (EPA. 1988. Guidance for conducting remedial investigations and feasibility studies under CERCLA. Interim final. EPA/540/G-89/004, OSWER Directive 9355.3). Because this is the RI phase, the chemical-specific cleanup criteria as preliminary remedial goals are not yet needed. However, because we have completed the RI phase, the remedial objectives previously identified in the scoping and work plan phase should be refined and presented in the pertinent section of the RI report. The refined RAOs need to identify the chemicals, media, and pathways that are to be addressed by remedial technologies in the FS. Based upon the summary information presented in Table 7-9, the conclusion can identify if certain initial RAOs are achieved because current and reasonable future conditions are protective, and which RAOs may need to be achieved through remedial alternatives that can be evaluated in the FS.	See response to general comment 5.
68) Section 7 Table 7-9 regarding Facility soil and the berm: There appears to be implication that because the berm is currently vegetated and because RI fieldwork did not observe erosion, that the chemicals in the berm may not migrate and may not present a	See response to general comment 5.

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threat. The current conditions are not a good indication of the future and without specific controls Facility soil, including but not limited to, the berm soil could become exposed and migrate. The information in Table 7-9 should include statements regarding which of the RAOs and site conditions that may need to be addressed by remedial alternatives that can be evaluated in the FS. In addition, “worker exposure” to Facility soil could include the berm soil.	